HANDBOOK OF THE FARM SERIES

EDITED BY J. CHALMERS MORTON.

THE

DAIRY OF THE FARM.

BY

JAMES LONG AND J. C. MORTON.

LONDON:
BRADBURY, AGNEW, & CO., 9, BOUVERIE STREET.
1885.

THE present Volume is one of a series discussing the Cultivation of the Farm, its Live Stock, and its Cultivated Plants, the Farm and Estate Equipment, the Chemistry of Agriculture, and the Processes of Animal and Vegetable Life. Among the writers who have been engaged on them are Messrs. T. BOWICK, W. BURNESS, G. MURRAY, the late W. T. CARRINGTON, the Rev. G. GILBERT, Messrs. J. HILL, SANDERS SPENCER, and J. C. MORTON, Professors J. BUCKMAN, J. WORTLEY-AXE, and J. SCOTT, Dr. M. T. MASTERS, F.R.S., and Mr. R. WARINGTON, F.C.S.

J. C. M.

PREFACE.

THERE is no branch of English Agriculture which has more profited by the spirit of investigation and the practice of recording observations which have of late more or less possessed us all. To Mr. H. M. Jenkins, of the Royal Agricultural Society, we are indebted for a knowledge of French and Danish Dairying, which has done a great deal during the past ten years to improve our own dairy practice. And to the rivalry and records of breeds and of individual animals on the other side of the Atlantic we owe a knowledge of the possibilities of milk and butter produce of which no idea formerly existed. It is not too much to say that the traveller and the enthusiast, the inventor and the chemist, have together of late years lifted what

used to be the homeliest and most stagnant of all departments of our Agriculture into the very foremost rank of all, so far as energy, activity, and all the other evidences of life are concerned. In the following pages, accordingly, along with the substance of a former handbook* published many years ago for the present writer, there will be found not only those pages brought down to the present date and re-written and condensed, but much added information on Foreign Dairying, contributed by Mr. James Long, and a tolerably full account of the improved practice and experience in our own Dairy districts at home.

J. C. M.

* "Handbook of Dairy Husbandry," by J. Chalmers Morton. Longmans. 1860.

CONTENTS.

THE DAIRY OF THE FARM.

INTRODUCTION.

A BOOK on Dairy Husbandry ought to describe the management of the farm so far as that is directed to the production of milk, as well as the processes of the dairy by which that milk is made to yield its various marketable products.

The present Handbook is, however, one of a series; and some of the topics included in an extended review of dairy farming have been discussed elsewhere. The particular management both of breeding stock and of the crops cultivated for their food has already been described. In the Handbook of the Livestock of the Farm, also, there are chapters on dairy and other breeds of cattle, and short instructions are given not only on the duties of the herdsman, but on those of the dairyman also; and the reader will find, in a condensed form, some of the information which is more fully given here. Although, therefore, in the present Handbook it is intended to give shortly the answers of experience to such questions as—What crops should be grown? what cattle should be kept? how should they be managed? in order to the production of the largest quantity and best quality of milk?—yet our chief purpose

is to give in full the information which the dairyman rather than the farmer needs, and in chapters on dairy statistics, on the food and choice and treatment of the cow, on milk, butter, cheese, and general management, and on foreign dairying, to describe the experiences of the dairy farmer and the manufacture of butter and cheese, as carried on in foreign countries and in our best dairy districts.

CHAPTER I.

DAIRY STATISTICS.

Dairy Produce—Milk—Butter—Cheese—Stock and Produce per acre—Stock and Produce of the Country.

THE butter made from a given quantity of milk, is rarely more than 4 per cent., varying from one thirtieth to one twentieth of its weight. The cheese made from a given quantity of milk is generally less than one tenth part of its weight. The quantity of butter and of cheese which milk will yield depends upon the breed of the cow and its individual character; upon the number of weeks or months during which it has already been in milk; and upon the food which it receives. All these particulars are included in the general management of the dairy farm. But it also depends upon the methods of dairy management adopted, the details of time, of temperature, and of manipulation in churning, cheese-making, &c. Add to the influence of all these circumstances affecting the quality of dairy produce the fact that the quantity of milk which a given extent of land will yield varies enormously with the way in which it is cropped and stocked; and it will be easily understood how the widest diversity of experience and opinion in dairy management comes to prevail.

It may be observed here, although the chemistry of the

subject has been elsewhere discussed, that the quantity of butter and of cheese respectively which milk yields to the dairyman, differs materially from the quantity which it yields on examination by the chemist. The caseine, or strictly cheesy part of milk does not generally exceed 4 per cent. of its weight; but the cheese of the dairy contains much besides the mere caseine of the laboratory; less than one third of it generally is caseine; nearly one third of it in the richer kinds of cheese is butter; more than one third of it often, when purchased by the factor, is water, and 3 or 4 per cent. of its weight is salt and other mineral matter. It may well be then that 4 per cent. of caseine in the milk should yield 10 per cent. or even more of marketable cheese. And so with the butter of the market; it differs considerably from the butter of the laboratory, containing in addition to the pure fatty matters of which alone the chemist takes account, 2 or 3 per cent. of cheese, and 15 or 16 per cent. of water. And if these additions do not increase the butter made in the dairy beyond that which is extracted in the laboratory, it is because so much is often lost in the former by the imperfect means of separating it which are there adopted.

The object of the dairy farmer being to derive the largest profit from his land, he crops the arable portion, and manages the pasturage so as to keep a full dairy stock; these he selects of the best kinds, and from the best breeds for the produce of butter or of cheese, according to his purpose. Having thus insured the largest produce of the kind of milk desired, he regulates his dairy management so as to obtain from it, as cheaply as possible, as much of the best made cheese or butter as it will yield. Successful dairy farming thus implies a knowledge of the

crops, the stock, and the dairy management best adapted to a profitable yield of butter or of cheese. And these are the three divisions under which it is proposed to arrange the details of dairy experience in the following pages, this preliminary section being devoted to a statement of its gross results in a considerable number and variety of instances.

The Yield of Milk.—In the cases given the breed and the manner of feeding are mentioned, and the number of cows of which the experience recorded was true is stated when known. On the late A. B. Telfer's farm, Canning Park, near Ayr, whose dairy of forty-seven cows was of Ayrshire breed, the average yield was 30,660 gallons annually, or 650 gallons apiece. This is probably over an average yield, but from what an extraordinary variety of experience anything like an average must be calculated every dairy farmer knows. Thanks very much to the British Dairy Farmers' Association and the example of Mr. E. C. Tisdall, of the Holland Park Dairy, Kensington, one of its most energetic and public-spirited members, we have now many dairy records kept, and some of them have been published. Mr. J. N. Edwards, of St. Albans, who won the prize of the society for the best dairy record in 1883, reported that from 30 cows nearly always in milk he obtained in 40 weeks 13,630 gallons of milk, or 447 gallons apiece in that time. The experience here was made up of maxima such as that of the cow "Mustard," which produced 1,100 gallons in twelve months, milking thirteen months continuously and yielding 1,279 gallons in all, and of others yielding 514, 322, 376, 490, 645, 917, and 537 gallons respectively. Mr. J. T. Harrison, of Frocester

Court, Stonehouse, Gloucestershire, reports a year's produce of 55 cows at 31,728 gallons, or 577 per cow, besides the milk used in weaning 43 calves; these were cross-bred shorthorn cows. Mr. Boyd Kinnear reports the produce of a small dairy of Guernsey cows during ten years as 616 gallons apiece. In the year 1883 eight cows yielded from 481 to 660 gallons apiece, averaging 550 gallons. Five selected cows have their life history given. One was milked twelve years, averaging 553 gallons annually; another nine years, averaging 743 gallons. Mr. Hosley, of Lord Braybrooke's home farm at Audley End, near Saffron Walden, reports in the *Agricultural Gazette* of February 25th, 1885, the records of a Jersey dairy, of which the following are the principal items:—twenty cows of all ages produced 9,577 gallons, or 478 gallons apiece, of extraordinarily rich milk. The individual cows varied from 900 gallons annually to 230 gallons. The average per cow in three years was 445, 465, and 689 gallons for the cows under four years, between four and six, and over six years old respectively for 1882; and the corresponding figures for 1883 and 1884 were 461, 443, and 483 for 1883, and 390, 413, and 606 for 1884.

From these instances it may be safely gathered that the average yield of well managed cows varies from 480 to 600 gallons of milk a year, according to breed and size; the smaller breeds, such as the Kerry, yielding considerably less than the former of these amounts; and the larger Yorkshire, short-horned, and cross-breeds yielding as much or even more than the latter.

It will also be understood that, by rich feeding and first-rate management, the average yield of a small dairy breed like the Ayrshire may be raised as high as 600 or 650

gallons annually; and that, by corresponding treatment of the larger breeds, their yield may be raised as high as 800 gallons and upwards, as in some of the instances quoted. The experience of London dairymen proves, indeed, that these figures may be exceeded; and where cows are kept solely for the provision of milk, and replaced by others at a loss of 6*l.* or 7*l.* apiece so soon as their yield falls below about six quarts a day, the annual yield of the large-framed Yorkshire cow may, by good feeding, be kept at nearly 1000 gallons annually on the average number of the herd in stall throughout the year.

The Yield of Butter.—Mr. Haxton, in his article on Dairy Husbandry in the *Agricultural Cyclopædia*, speaks of churning 100 gallons of midsummer milk from Fife-shire cows, and obtaining 27½ lbs. of butter. This was at the very low rate of 1 lb. to every 29 pints. Mr. Aiton, who has written on the Dairy Husbandry of Ayrshire, reports the milk of Ayrshire cattle as ordinarily yielding 1 lb. of butter to every 20 pints.

The following are other instances of annual produce of butter per cow. Mr. Telfer's ordinary produce of butter from Ayrshire cows was 11lb. for 20½ pints of milk, or rather more than 2½ gallons; but when the milk was richest it yielded 11lb. per 18 pints, and when poorest 11lb. per 24 pints.

Mr. Williams, county Cork, in one of the most fully detailed accounts that exists of dairy experience (*Agricultural Gazette*, 1855), stated that feeding "well-bred Irish cows" on grains nearly all the year round with grass in summer and hay in winter, he found that 384½ gallons of summer milk yielded 136¼ lbs. of butter, or 1 lb.

from 22½ pints of milk, and that 198⅞ gallons of winter milk gave 81½ lbs. or 1 lb. of butter from 19½ pints. The whole year's yield was 583 gallons of milk and 218 lbs. of butter per cow, or 1 lb. to every 21½ pints.

The late Mr. Horsfall of Burley Hall, near Otley, found 4 gallons of milk yield from 24 to 27 ozs. of butter, corresponding to 1 lb. to every 21 and 18⅔ pints respectively; and his cows annually produced on an average 266 lbs. of butter each.

We have of late years been startled by extraordinary records of butter produce from America, where Jersey cows have been cultivated and stimulated to an almost incredible productiveness; and in place of the respectable average of 600 gallons annually, capable of yielding 2 cwt. of butter in the year, which is a good ordinary English experience, we are told of cows yielding twice and even three times as much. Mr. Hosley, of the Audley End Jersey Dairy, whose figures we have already quoted, gives the following averages for 1882, 1883, and 1884 respectively:—cows under four years of age, 240 lbs., 264 lbs., and 194 lbs. respectively for the milk as recorded above; cows between four and six years of age, 281 lbs., 268 lbs., and 259 lbs. respectively, and cows over six years of age, 353 lbs., 274 lbs., and 311 lbs. respectively. Over the whole herd in the three years the produce was 283 lbs., 269 lbs., and 257 lbs. apiece. And some examples of extraordinary yield are given, almost rivalling the American reports. Thus, No. 8 produced 407 lbs. of butter in 49 weeks in 1882; No. 11 in 1883, No. 10 and No. 17 in 1884 produced over 390 lbs. each. We fear agricultural maxima have little influence on agricultural averages; and while we do not refuse our belief to even the marvellous stories told of Eurotas and other

extraordinary American Jerseys, we fear that in ordinary cases 1 lb. of butter from 20 to 21 pints of milk and 200 lbs. of butter per annum, is more nearly the ordinary experience of the larger breeds of dairy cows in this country. How great the contrast presented by the Jersey under its best circumstances is to this, Mr. Hosley's experience proves. His Jersey cows yielded a pound of butter to every 7 quarts in 1882, every $6\frac{2}{3}$ quarts in 1883, and every $7\frac{1}{3}$ quarts in 1884, and varied from $12\frac{3}{4}$ quarts to a pound in the poorest instances to milk so rich that a pound of butter came from every $3\frac{3}{4}$ quarts.

The Yield of Cheese.—The following are illustrative cases:—Mr. White of Warrington, in his account of Cheshire cheese-making (*Agricultural Society's Journal*, vol. vi.) gave three instances in one of which from 211 gallons of milk, 4 cheeses were made, weighing "a day or two after making" $226\frac{1}{4}$ lbs.; this was at the rate of 1 lb. for rather less than $7\frac{1}{2}$ pints of milk. In two additional cases he reported that 43 gallons of milk yielded a cheese weighing 47 lbs. eight months after making, and 107 gallons yielded two cheeses, weighing 110 lbs. a month after making. Adding them together, they indicated an average yield of 1 lb. of cheese from $7\frac{2}{3}$ pints. Mr. Haxton reported the produce of cheese in six Ayrshire dairies as being 1 lb. to every $7\frac{8}{9}$ pints. The quantity yielded per gallon is greater in the autumn than in the spring; and whereas in June it may take 11 lbs. of milk to yield one of cheese, in September and October 9 lbs. of milk will yield as much.

In Dorsetshire, where milk is largely used for the production of butter and skim-milk cheese, it is stated that the average yield per cow is 168 lbs. of the former, and

about 200 lbs. of the latter annually. Mr. M'Adam of Silverdale, near Newcastle, Staffordshire, reported of his dairy of 100 cows, that their milk produced 1 lb. of cheese per gallon, equal to about 4¾ cwts. apiece per annum. There were given in the *Agricultural Gazette*, some years ago, the statistics of fifteen dairy farms, from which it appears, that 439 cows produced annually 1604 cwts. of cheese, besides 5268 lbs. of milk-butter, and 11,420 lbs. of whey-butter, and rearing eighty-five calves. If we deduct thirty-nine cows for the milk for these calves, then it appears that the remainder produced 4 cwts. of cheese, about 13 lbs. of milk-butter, and 28 lbs. of whey-butter annually a piece. To these we may add, from personal knowledge of the Gloucestershire dairy district, that while variations of season and consequent differences in the quantity of grass produced will occasion differences in the produce of cheese from as low as 3 cwts. to as high as even 5 cwts. per cow in extraordinary cases over whole dairies, the average yield of cheese on well managed dairy farms, where ordinary care is taken in the selection of cows and maintenance of the herd, approaches 4 cwts. per cow. Mr. White reported, as the average experience of dairy farmers in Cheshire, that on land worth 30*s*. per acre, 3 cwts. of cheese per cow is the average produce; "but in a few instances, 5 cwts. per cow, and even more, is sometimes made." It may be added, that in Ayrshire a stone (24 lbs.) of cheese is generally made from 90 quarts of whole milk, or 1 lb. of cheese from every 9½ lbs. of milk; and that the same quantity of skim milk cheese is made from one half more, or 135 to 140 quarts, *i.e.* 1 lb. of cheese from every 14 lbs. of skim milk.

The "half coward" cheese of Gloucestershire, made from the whole milk of the morning mixed with the milk of the previous evening's meal, skimmed after 12 hours' standing, is yielded at a midway rate, as 1 lb. from 11 or 12 lbs. of the milk from which it is made.

Stock and Produce per Acre.—On this point, four or five cases of actual experience may be quoted. In the case of the First Prize Dairy Farm, near Shrewsbury, in 1884, a herd of 50 cows on 185 acres, two-thirds pasture, produced close on 5 cwts. of cheese per acre, besides some 30 cwts. of butter in the year. Here the cows were a very good dairy shorthorn, fed liberally throughout the year. In other instances known to me 19 cows have produced 65 cwts. of cheese, 77 cows have produced 320 cwts., 37 cows have produced 130 cwts., and 43 cows have produced 161 cwts. in the year, besides varying small quantities of butter derived partly from the whey and partly from the evening's milk—which is creamed, especially in the latter months of the year, when it is richer, before being added to the morning's milk. The following are other examples. The late Mr. Palin's farm at Stapleford Hall, near Tarvin, Chester, now in the occupation of Mr. John Lea, consisted of 180 acres of pasture land, and 65 acres of tillage, and 5 acres of homestead and garden; and it carried 52 dairy cows, besides 60 or 80 fatting sheep, and 40 or 50 ewes with their lambs, together with 15 or 20 calves, and as many yearling, and two-year-old heifers. Putting the average annual yield of cheese at fully 3 cwts. per cow, this amounts to 100 lbs. of cheese per acre from the grass land, without taking account of the sales of other stock on the one hand, or the acreage of arable land on the other,

from which, during winter, the herd is to some extent maintained. Mr. White, of Warrington, says, in the *Agricultural Society's Journal*, vol. vi., that 15 to 18 cows are kept per 100 acres of grass land, and that a cheese of 36 to 54 lbs. is made daily from their milk during four or five months in summer. Assuming then that 45 lbs. of cheese are made during each of 140 days, we have 350 lbs. per cow, over 18 cows, but only 63 lbs. per acre over the 100 acres, owing to the large extent of land (more than 5 acres) allotted per cow. The 15 Gloucestershire dairy farms already referred to contain 1716 acres of pasture land and 258 acres of arable land. They produced 1600 cwts. of cheese, or 105 lbs. per acre (less than 4 acres are required per cow), besides keeping a stock on the whole of 85 calves and the same number of yearling, two-year-old, and three-year-old heifers, and a small flock (127) of sheep. The sales from this extent of land include in addition to this cheese 15 tons of bacon, 350 young calves, 85 old cows, and 8 lbs. of butter per acre. Mr. Caird in his "English Agriculture," in 1851, says, that of good grass land in Wiltshire, 2½ acres are reckoned sufficient to support a cow throughout the year; and, to give an idea of the quantity of stock actually kept in a particular instance, he adds: "We found a milking stock of 40 cows on a dairy farm of 120 acres." The same authority quotes the following particulars supplied to him in reference to Cheshire experience. "On 36 farms, containing 6600 acres 2200 of which were in tillage, a stock of 1176 cows, besides the necessary quantity of young cattle, is kept in this proportion:

First class,	600	acres at	3	acres per cow,	200	cows.
Second class,	800	,,	3½	,,	226	,,
Third class,	3000	,,	4	,,	750	,,

These examples are, however, instances rather of average than of possible produce. Good dairy farms will keep a cow for at most every three acres of pasture, and under good management, with some arable land in addition, a smaller extent will suffice. The object of a book on the subject should be rather to present the maxima of agricultural experience, and thus stimulate progress, than to dwell merely on averages, though a knowledge of these is necessary to a truthful statement of ordinary dairy statistics.

Stock and Produce of the Country.—In this paragraph we give such figures as the annual agricultural statistics of the country provide. It is significant of the growing extent of the share of the pastoral, grazing, and dairying interest in the agriculture of Great Britain that the area in permanent pasture has increased more than one-sixth during the past fifteen years. It was 12,735,897 acres in extent in 1869; it is 15,290,820 acres in 1884. Two and a-half millions of acres have been laid down with permanent grasses during this period. The number of cattle has also increased, though not in the same proportion. There were 5,313,473 cattle of all ages in 1869; there were 6,269,141 of all ages in 1884. Of these 2,390,863 were cows and heifers in milk and in calf. The corresponding figures for the United Kingdom, including Ireland, were 22,811,284 acres of permanent pasture in 1869, and 25,667,206 acres in 1884; 9,078,282 cattle in 1869, 10,097,943 in 1884, of which 3,724,528 were cows and heifers in milk and calf. With all deductions for those breeds which do little more than rear their calf, and for those breeds where the whole milk is devoted to the raising of stock and the fatting of veal, and considering, on the

one hand, the small yield of some breeds and on the other the large quantity produced by cows now fed especially for the yield of milk, we may assume that the 3,724,528 cows yield nearly 1,200,000,000 gallons annually. Of this at least one-twelfth is taken for calves; and if the consumption of milk, which has very greatly increased of late years, be put at over one quarter of a pint apiece daily, say 14 gallons a year for each one of the population, 500,000,000 gallons thus consumed must be deducted, leaving 600,000,000 gallons for the manufacture of cheese and butter, a quantity equal to the production of 580,000,000 lbs. of cheese or 240,000,000 lbs. of butter, or perhaps we may say 100,000,000 lbs. of cheese and 200,000,000 lbs. of butter—a quantity which would provide about one-eighth of an ounce of cheese and one-quarter of an ounce of butter apiece per head of the population daily. That this is not enough, and that there is a growing deficiency in the home supply, is proved by the increasing quantity of butter and cheese which is annually imported, as appears from the following table:—

Year.	Imports.		Year.	Imports.	
	Butter.	Cheese.		Butter.	Cheese.
	cwts.	cwts.		cwts.	cwts.
1869	1,259,082	979,189	1877	1,637,403	1,653,920
1870	1,159,210	1,041,281	1878	1,796,517	1,968,859
1871	1,334,783	1,216,400	1879	2,045,399	1,789,721
1872	1,138,881	1,057,883	1880	2,326,305	1,775,997
1873	1,279,566	1,356,728	1881	2,047,341	1,840,090
1874	1,619,808	1,485,265	1882	2,169,717	1,694,623
1875	1,467,870	1,627,748	1883	2,334,743	1,799,704
1876	1,659,492	1,531,204	1884	2,472,567	1,926,070

The imports, it will be seen, have nearly doubled during the past sixteen years.

CHAPTER II.

FOOD OF THE COW.

Pasturage—Summer and Winter Feeding—Relations of Food to Pasture—Malt and Barley—Crops of the Dairy Farm, Ensilage—Schemes of Cultivation for Dairy Farms.

It is intended in this chapter to describe actual practice in a number of instances of cow feeding; to state such facts as are known on the relations of various foods to the yield and quality of milk; and to enumerate the crops proper for cultivation on a dairy farm.

The Food of the Cow in the common practice of our dairy districts is pasturage in summer, and hay and straw with, in some cases, a few turnips or mangold wurzel in winter. She will consume in depasturing from 1 to 1½ cwt. of grass daily, varying of course according to age and size; or during seven months of grazing as much as 12 to 16 tons of green food. Pastures which would by July have growth enough on them to make from 20 to 40 cwts. of hay, and which will when that is cut grow probably three-fifths as much grass after July 1 as they had grown before, will, if their growth be eaten down from week to week throughout the season have produced from 7 to 14 tons of green food per acre. From 1¼ acre of the best grass lands to as much as 2½ of the poorer class will thus be wanted for the summer maintenance of the cow. One

acre of whole grass and the aftermath of another acre which had been mown for winter hay will in the former case be sufficient for a cow; and double that extent will be needed in the latter case. The cow will thus receive fully ¼ of a cwt. of hay daily during the five winter months. In Gloucestershire this is generally given it in the field; the cattle being foddered morning and evening unsheltered; and 2½ tons of hay a head are considered an ample winter's allowance. In Cheshire the dairy cows are more generally received into yards and stalls during winter: 2½ or 3 acres of grass land per cow are the general allowance in order to supply sufficient summer pasturage and winter provender; but the dairy farms in that county generally have a larger proportion of arable land attached to them, and it is common to give the cows turnips, mangold wurzel, and straw, as well as hay. The late Mr. Palin of Tarvin, near Chester, stated that his cows being gradually brought into yards towards winter, as the yield of milk ceases, are fed in stalls, first on mangold wurzel leaves, then on turnip-tops, and then successively on turnips, swedes, and mangold wurzel, along with cut straw and hay chaff. The feeding of dairy cows in Wigtonshire, includes 1¾ acre of pasture during summer, 4 tons of turnips during winter, and 2 bushels of beans given as bean-meal at spring time of the year. In Fifeshire, the annual feeding of the dairy cow is put at 2½ acres of grass, 9 or 10 tons of turnips, and 30 cwts. of oat straw as fodder, together with 1 ton of wheat straw as litter. It is the practice now to treat the cow much more liberally during the winter months and when she is dry than used to be the rule. The bare condition in which, after calving, the cow was often turned out to grass in spring is now quite understood to be bad farm management. The large

number of cows which are now brought to the pail in autumn for the provision of milk in winter for the supply of towns makes, of course, the distinction which used to obtain between winter and summer feeding no longer applicable, and the yield of milk is stimulated by the most liberal treatment. And when the object is to obtain the largest possible supply of milk during winter, house feeding is of course adopted. Here, great reliance is placed on grains, of which a bushel a day per cow or even more is given, together with 12 to 18 lbs. of hay, and ½ cwt. of roots, chiefly mangold wurzel, or in place of the two last, abundance of cut green food, clover, vetches, &c. during summer. This with ample supply of water forms the daily food of the large Yorkshire cows to be found in London dairies. A common method is to pasture the cows in summer, giving them cut green food in addition towards autumn and in early summer, and feeding in stalls or yards on roots, grains, cake, and hay, and steamed messes during winter. The practice of giving warm mashes is more common in the north. For small Ayrshire cows, the following has been found a sufficient winter dietary on which to keep them in full milk:—30 to 40 lbs. of boiled turnips, with 6 lbs. of cut straw, and 3 lbs. of bean-meal mashed up in them: straw *ad lib.* being supplied in addition. Mr. Horsfall's winter feeding was remarkably liberal, and he received his return for it in the fattening of his cows at the time they were giving milk. The following is the report to the English Agricultural Society of his management:—He had for four years given his dairy cows rape-cake, of the kind termed "green" cake, which imparted to the butter a finer flavour than any other kind of cake; and in order to induce them to eat it, he blended it

with one quarter the quantity of malt-dust, one quarter bran, and twice the quantity of a mixture in equal proportions of bean-straw, oat-straw, and oat-shells; all well mixed up together, moistened, and steamed for one hour. This steamed food had a very fragrant odour, and was much relished by the cattle: it was given warm three times a day, at the rate of about 7 lbs. to each cow (or 21 lbs. daily). Bean-meal was also scattered dry over the steamed food, cows in full milk getting 2 lbs. per day, the others but little. When the animals had eaten up this steamed food and bean-meal, they were each supplied daily with 28 to 35 lbs. of cabbages from October to December, of kohl-rabi till February, or of mangolds till grass time; each cow having given to her, after each of the three feedings, 4 lbs. of meadow hay (or 12 lbs. daily). The roots were not cut, but given whole. The animals were twice a day allowed to drink as much water as they desired.—Mr. Horsfall ultimately discontinued the use of bean-meal owing to its comparative price, and in its place, along with about 5 lbs. of rape-cake, gave an additional allowance of malt coombs, and 2 or 3 lbs. of Indian corn-meal per cow. On this food, in instances actually observed, his cows gave 14 quarts of milk a day, at the same time that they gained flesh at the rate of about one quarter of a cwt. per month.

As regards the summer feeding of these cattle, Mr. Horsfall says:—"During May, my cows are turned out on a rich pasture near the homestead: towards evening they are again housed for the night, when they are supplied with a mess of the steamed mixture and a little hay each morning and evening. During June, when the grasses are better grown, mown grass is given to them

instead of hay, and they are also allowed two feeds of steamed mixture. This treatment is continued till October, when they are again wholly housed. In January, 1854, I commenced weighing my milch cows; and I have continued this practice once a month almost without omission. I find that cows in full milk yielding 12 to 16 quarts each per day vary but little in weight, some losing, others gaining, slightly. It is common for a cow to continue from six to eight months before she gives below 12 quarts per day, at which time she has usually, if not invariably, gained weight. The cows giving less than 12 quarts, and down to 5 quarts per day, are found when free from ailment to gain without exception. This gain, with an average yield of nearly 8 quarts per day, is at the rate of 7 to 8 lbs. per week each." This, of course, is only in the case of cows not in calf, intended to be dried and sold fat.

Relations of Food to Dairy Produce.—It is difficult to say of any agricultural result how much of it is due to any particular cause; and in the case of dairy produce, so many causes contribute to the result that the difficulty is greatly increased. The breed, the individual character of the cow, its treatment, and the dairy management of its milk—all, as well as the food which it receives, affect the quantity of butter or of cheese which is obtained from it: and thus any comparative experiments in order to ascertain the effect of particular foods must be carried on for a length of time before their results can be considered trustworthy.

The following are experiments quoted in the Journal of the Albert Institution, Glasnevin, Dublin. The first table gives the result of a weekly observation of the food and produce of cows during the months named. During the

first week, 5 cows were observed, during the second, 7 cows, and during the others 6.

Week ending.	Kind of Feeding which the Cattle received.	Produce.		Number of Quarts of Milk to produce 1 lb. of Butter.
		Gallons of Milk.	Pounds of Butter	
May 27	Clover and rye-grass, with a few hours' grazing . . .	89⅜	30	11·9
June 28	Winter vetches, and grazing as above	122½	39⅜	12·32
July 27	Clover and rye-glass, second cutting .	96½	26½	14·7
Aug. 25	Cabbages and grazing	87	26	13·38
Sept. 29	Clover, third cutting	74	23	12·86
Oct. 25	Mangold-wurzel leaves and hay . .	50½	15½	13·3
Nov. 28	Mangold-wurzel leaves and hay. .	40¾	15	10·86
Dec. 19	White turnips and barley straw . .	33¾	14½	9·47

The richness of the milk increases, as its quantity diminishes. This indeed appears to have had a more powerful influence than the varying character of the food. The ration of mangold leaves proved, however, an exception to this rule.—The following is another series of weekly experiments lasting over several months. In the first week, the number of cows observed was 7, and in the others 12.

Date at which the Experiment was finished.	Kind and Quantity of Feeding per Head Daily.	Duration of Experiment.	Produce.		Number of Quarts of Milk to produce 1 lb. of Butter.
			Milk.	Butter	
		Days	Gals.	Lbs.	Quarts.
April 11	70 lbs. of mangold-wurzel and 50 lbs. of turnips . . .	3	42¾	19	9
July 11	Italian rye-grass, *ad libitum* . .	7	173	75	9·22
Sept. 18	Second cutting of clover . . .	7	131	60	8·73
Sept. 25	Cabbages	7	144	62	9·29
Oct. 2	Mangold-wurzel leaves and cabbages	7	162	60	10·8
Oct. 9	Mangold-wurzel leaves alone . .	7	212	86	9·86
Dec. 1	50 lbs. of mangold-wurzel and 60 lbs. of turnips . . .	7	168	74	9·08

We have now to refer to the more exact, but shorter experiments of scientific men. Those of Boussingault, on his farm at Bechelbronn, in one case lasted over eight successive weeks, and in another over four successive weeks, with the following results:—The foods given are named in the first column, the daily ration of the several foods being calculated according to a recognised table of equivalents, as equal in every case to 33 lbs. of hay.

Food given during successive weeks.	Quantity of Milk daily.	Percentage composition of Milk.				
		Casein.	Butter.	Sugar.	Ash.	Water.
First Series.	pints.					
Hay	9·3	3·4	4·5	4·7	0·1	87·7
Turnips and straw	10·5	3·0	4·2	5·0	0·2	87·6
Wurzel and straw	9·8	3·4	4·0	5·3	0·2	87·1
Raw potatoes and straw	8·7	3·4	4·0	5·9	0·2	86·5
Hay	6·2	—	—	—	—	—
Raw potatoes, salt, and straw	5·9	—	—	—	—	—
Jerusalem artichokes	6·0	3·3	3·5	5·5	0·2	87·5
Second Series.						
Hay and clover	18·6	3·0	3·5	4·5	0·2	88·8
Green clover	21·2	3·1	5·6	4·2	0·3	86·8

It seems plain that the results of the first series, as indicated by the diminished yield of the cow on hay, were vitiated by the general diminished productiveness of the animal with the lapse of time.

Another elaborate series of experiments on this subject was published by Dr. R. D. Thomson, who many years ago compared the effect of barley, malt, barley and molasses, barley and linseed, and bean-meal, in their effects on the quantity and quality of the milk yielded by two cows on these diets respectively, during successive periods, generally of 10 or 15 days. The following results are condensed

from the tables in which he gives a summary of his observations :—

Duration of Experiment.	Daily Food consumed.		Daily Milk.	Yield of Butter per Cow.
Days.		Lbs.	Lbs.	Oz.
15	Barley	10	21¼	10⅛
	Hay	29½		
15	Malt	10½	20½	10⅛
	Hay	27½		
10	Barley	9	21½	11 1/10
	Molasses	2⅝		
	Hay	27		
10	Barley	8	21¾	11
	Linseed	4		
	Hay	25½		
5	Bean-meal	11	21½	12
	Linseed	⅝		
	Hay	24½		

There do not appear from these figures to be any very marked differences either in the quantity or quality of the milk produced from these varying foods. Dr. Thomson gave as the result of his whole series of experiments, the following conclusions, which are calculated from his tables, and may be taken as illustrative of the effects of the several dietaries which he tried upon the quantity of butter produced.

Duration of Experiment.	Food consumed Daily—calculated Dry.			Total Dry Food Daily.	Milk yielded Daily.	Produce from 100 lbs. of the Dry Food.	
	Grass and Hay.	Grain, &c.				Milk.	Butter.
Days.	Lbs.		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
28	26·2	Grass, daily	10·2	26·2	23·	11·6	2·71
22	26·4	Whole barley	3·9	30·3	20·3	8·41	1·82
20	26·35	Whole malt	5·3	31·6	19·7	7·08	2·07
32	24·4	Crushed barley	10·2	34·5	21·	8·64	2·11
32	23·3	Crushed malt	10·2	33·5	20·	7·95	1·92
20	21·	Barley, 8·15; molasses	2·7	31·85	20·35	8·06	2·19
20	21·83	Barley and linseed	10·67	32·25	21·8	8·45	2·15
10	22·5	Peas	10·7	33·2	21·5	8·13	2·25

It must be remembered that no information is given directly in this table on the cost of the butter or milk produced by these several feedings, though this may be calculated from it by any one who shall take the trouble. The maxims of ordinary experience are, however, to be taken as of superior importance to scientific observations of such limited duration: and these are—(1), to maintain the cow in vigorous health, whatever may be the food provided—(2), to give it unrestrained access to good water —and (3), to change the food as often as possible, whether by turning into a fresh pasture, or by alteration of winter feeding in the stall.

Crops and Foods for Dairy Stock.—The cultivation of the crops suitable as food for dairy stock has been described in another Handbook. At present, a mere list will be given of these crops, with a reference to their probable yield per acre, the period of year during which each is available, &c. (1.) *Pasturage.* The grass of old meadows of good quality is the best possible summer food for dairy cows. They will thus consume from 1 cwt. upwards of green food daily. The annual yield of grass from meadows will vary from 7 tons per acre during the season up to 14. It is available in this climate generally, from early in May till the middle of November or later, during which time an ordinary cow will consume from 10 to 14 tons of green food. (2.) *Hay,* well made from good meadows, is the very best winter food for dairy cows. It is economised by the addition of straw and roots and meal, &c., but when given alone, must be supplied at the rate of ½ cwt. daily, or thereabouts, a-head. (3.) *The Clovers* afford capital grazing for young stock, and on arable dairy

farms to milch cows also. They may yield on good land, well cultivated, in 2 or even 3 cuttings, if the season be favourable, 10, 6, and 4 tons respectively per acre; or from 12 to 18 tons per acre during the season. If the cattle are foddered, as in small dairies they may be, these and other green foods must be supplied at the rate of fully one cwt. each cow daily. They are available from June or July till October. (4.) *Vetches* sown in October, and again in April, May and June, may be made to provide a succession of food all through the summer, commencing in May. They yield one cutting, which may furnish from 6 to 10 tons of green food per acre; a very succulent food if given before its flowers appear; and the better, therefore, for being cut 12 or 24 hours before use, in order to wither and harden somewhat. They may be given with good effect, cut up along with straw or chaff. (5.) *Rye* cut green is one of the earliest of spring foods; sown shortly after midsummer it is available early in April, yielding perhaps 4 or 5 tons per acre of green food, and more as the crop approaches maturity, when of course it becomes less useful as food. (6.) *Italian Rye-grass* is one of the best forage plants for cows when cultivated liberally. If manured abundantly after each cutting, especially if the dressing can be washed in by irrigation, another cutting, weighing 10 or even 15 tons per acre, will be ready in a few weeks. And as many as five heavy cuttings have been obtained from it in the season on sewage farms. When sufficiently ripened, it is the best possible cut food that can be given to cows, inducing an abundant yield of excellent milk. (7.) *Lucerne*, on deep, rich, and sheltered soil will also yield a succession of cuttings of excellent food for cows, weighing, if the intervals between the rows be forked and

manured after each cutting, from 6 to 8 tons per acre each time. It is not always at once very welcome in cow food. There is a certain bitterness that is distasteful, and we have known of late when it has been given as a useful food cut up in the chaff-cutter and sweetened with the addition of a pint of treacle or 1 lb. of coarse sugar, both of them cheap foods just now (1885). (8.) *Sainfoin* may be classed with the clovers as to quality and quantity of produce, but can rarely be cut more than once a year. It is available for several years on the same land, requiring of course to be manured if constantly cut; suitable for rocky and calcareous soils, where clovers are not generally so successful; and yielding probably 10 to 12 tons of green food, under ordinary management, per acre. (9.) *Gorse* crushed, and given with other food, is liked by cows, and has been successfully used in dairies. It is available during November and the winter months, and, given at the rate of two bushels of the bruised material along with carrots, and a little hay, is one of the best winter foods for cows in milk. (10.) *Rape* is useful in early winter, less liable to affect the taste of the milk than some other green foods, and a very succulent and palatable food. Capable of being mown and brought in daily from the field, it is available as a daily food during September, October and November, and indeed formed a portion of Mr. Horsfall's feeding of his well-managed dairy herd. A crop of rape will yield from 10 to 12 tons of green food per acre. (11.) *Cabbages* of various sorts, open and hearted, early and late, are liked by cows, and may be made to yield a succession of food from May all through summer, and on till the end of the year. Land yielding successive crops of cabbages may be made to yield

an enormous weight of food—even 40 or 50 tons per acre during the season. Not more than half a cwt. a day, supplemented with more substantial food, should be given to a cow; and care should be taken to remove any spoiled portions of the food, which, if consumed, would greatly aggravate the disagreeable flavour which, under the most careful management, they are apt to give to the milk. (12.) *Turnips*, common and Swedish, are given to cows, the former in early winter, the latter on till towards spring. They will yield from 10 up to 20, and even 25 tons per acre, but they are faulty, owing to the taste which, without special management of the milk, they give to it. Sixty to eighty lbs. of these roots daily, along with an unlimited supply of straw, is an ordinary daily ration. These roots are less liable to affect the milk if steamed, or even if merely pulped: 15 or 20 tons of common turnips per acre, and 12 to 15 tons of Swedish turnips, are an ordinary crop, but they are liable to so many casualties from weather, insects, &c., that no great dependence can be placed on them for a small dairy. (13.) *Mangold Wurzels* are the best root crop for winter and spring feeding of milch cows. They give a slightly bitter taste to the milk, and their extreme succulence as food is not favourable to the richness of the milk. Not more than ¾ cwt. should be given daily when they are the sole dependence along with straw: and a smaller quantity along with richer food is better management in butter dairies. Thirty tons per acre can be grown more easily than 20 tons of turnips, and in the following spring and summer they are better food per ton. (14.) *Kohl Rabi*, is a hardy and useful crop on dairy farms, yielding perhaps 12 or 14 tons of stems, and a useful top as well, which cattle eat with relish. (15.) *Carrots*,

especially the large Belgian sorts, can be grown with great advantage on a dairy farm; 10 to 12 tons are a good ordinary crop. They do not give a disagreeable taste to the milk, and are extremely palatable to the cattle. Half a cwt. a day might be given along with other food. (16.) *Parsnips*, while not so palatable as carrots, and more proper to be given in a steamed or boiled mess, along with other food, are even more nutritive, and enrich the milk. Of the large Jersey parsnips, 10 or 12 tons per acre have been grown. (17.) *Potatoes* when steamed, if at hand in sufficient quantity for such a use, are excellent cow food; and even raw they are sometimes used, but with less advantage. (18.) *Straw* of our various corn and pulse crops is used as winter fodder in the cow-yard. Cooked bean straw, if the crop has been well harvested and cut before it was dead ripe, is nutritious fodder. Pea-straw, if free from mildew, is also good food; and clean wheat and oat and barley straw is often almost the sole fodder of dry cows and young stock through the winter, with a very few turnips. If a portion of the straw be cut to chaff, and wetted with a hot and salt sort of linseed soup, made at the rate of about ½ a lb. of the linseed to each of the cattle, store stock can thus be kept in very good condition through the winter. (19.) *Meal* of the various grains—wheat, barley, oats, beans, peas—also of linseed and Indian corn, is used more or less in cases where rich feeding of dairy cows is adopted. Bean, barley, and India-meal are probably more commonly used than any other, and the first seems especially fitted as food for cows in milk; a pound or two sprinkled in the course of the day over the ration, cooked or otherwise, as the cow receives it, is generally well repaid. The relative uses of barley meal and malted barley have

been already referred to. The experience of most practical men seems to be in favour of the malt. The only exact record of experience on the subject, however, asserts, what theory would predict, the superiority, as food, of the barley which has not undergone the malting process. *Linseed*, ground or bruised, forms a useful addition to the steamed or boiled mess given to the cow. The whole-meal of wheat, so long as wheat is no higher than 5*s*. a bushel, ought to displace some of the higher priced foods one has been accustomed hitherto to use. (20.) *Cakes* of our various oil-producing seeds, are among the best of cattle foods. Linseed cake stands highest on the list, and is the most costly. Cotton-seed cake produced from decorticated seed, has taken a high place among other cattle foods. (21.) *Carob beans*, a sweet pod eaten with great relish by sheep and cattle, is capital food for milch cows. (22.) *Molasses* are sometimes used as food for dairy cows, and 3 or 4 lbs. thrown over a mess of cooked chaff and a few turnips, induce to larger consumption of comparatively unpalatable food. In Dr. Thomson's experiments, molasses were proved to be a useful food. (23.) Of all the foods used in milk dairies, where cows are fed nearly all the year in the byre, nothing equals brewers' grains for stimulating the production of poor milk: from 2 to 4 pecks daily are given to each cow. Gradually mixing a little with their ordinary ration, they will ultimately take it greedily. Grains from the smaller breweries are believed to be the best. They and the waste liquor of distilleries are used largely in town dairies. Both, however, diminish in value with every improvement in the processes adopted for extracting the nutritive part of them in brewing or distilling. (24.) *Salt* should be placed within reach of the

cow, and a lump to lick at in her manger is perhaps better than the direct addition of so many ounces daily in her food.

We must not forget to mention, what is virtually a new source of succulent food in winter, the practice of ensilage which has lately been introduced to this country from the Continent, and which is being rapidly adopted in many districts of this country. Green grass, or rye, or clover is packed tightly in pits, and kept there under a pressure of 1 cwt. or more per square foot of surface, and is found at the end of many months in a perfectly palatable condition for dairy stock, so as to be available all through the winter. Mr. Kirby, of Hook Farm near Bromley, has fed more than 100 cows during the past winter (1884–5) on the contents of his silos, in which mown grass cut the previous June had been cut into chaff, and packed and pressed. And this is now a not uncommon experience. Cows fed on 50 lbs. of ensiled grass, with some 30 lbs. of grains, and 2 or 3 lbs. of cake, and as much barley-meal, yield abundant milk of admirable quality. When the grass is put at once under pressure, planks being placed upon it, and some two feet of clay piled on the planks, it comes out six months afterwards wet and sour, with a smell something between those of the brewhouse and the tanyard, but nevertheless very palatable to the cattle. It is possible, by allowing the piled grass to attain considerable heat before pressure is applied, to avoid the sour fermentation, so that the stuff comes out sweet and with a pleasant odour; and in this condition we should think it preferable as cow food.

The Cropping of Land for the Cow, notwithstanding the variety of foods available for her, is generally a very

simple matter. Almost all the butter and cheese made in this country is made from grass-fed cows, and what there is of winter produce comes from hay, or occasionally roots, *i. e.* turnips and mangold wurzel, and straw; while the milk with which our towns are supplied comes from brewers' grains, together with cut vetches and clover in summer, and hay and mangold wurzel in the winter. There is, however, room for a great deal of economy yet in the utilising of the dairy farm, by adapting its arable part more directly to cow-feeding, and so enabling the keeping of a larger stock of cattle. Let us take an instance or two of small farms available for dairy management, and see how far arable crops enable us to increase the stock of dairy cows beyond the "one to every three acres," which is the average of our ordinary dairy districts. The following paragraphs describe actual cases in which the advice of the writer was applied for:—

(1.) "*Hill Side*" had 15 acres of poor grass land and 35 acres of arable land, 5 of which were in sainfoin. Let us see how many cows he could keep. The 20 acres of grass and sainfoin may be supposed to yield 200 tons of green food; and of the 30 acres of arable land, 20 acres in clover, mangold wurzel, carrots, parsnips, and Swedish turnips, might produce annually nearly 400 tons; while the remaining 10 acres in grain crops would produce, say 15 tons of straw: 580 tons of food, at 120 lbs. each per day, would keep 26 or 27 cows throughout the year, and the 15 tons of straw would litter them in winter. This calculation is on data which will hold true whether the grass be made into hay or not. And the following is a rotation which would bring out the quantities and kinds of produce suggested. It will be seen that the cattle will be much more

easily kept in winter than in summer. It is for summer food that the difficulty will be felt. Let half the sainfoin and nearly half the grass land be mown each year, and 5 acres of the arable land be in clover, to be cut and carried to the cattle in the house. The 30 acres of arable land may be divided into 6 fields of 5 acres each. 1st year, wheat sown with clover seeds; 2nd year, clover; 3rd year, swedes; 4th year, wheat; 5th year, mangold wurzel; 6th year, carrots.

		Summer food.		Winter food.
5 acres of clover	. . .	60 tons.		—
5 ,, swedes	. . . .	—		100 tons.
5 ,, mangold wurzel	. .	80 ,,	and	80 ,,
5 ,, carrots	. . . .	30 ,,	,,	30 ,,
5 ,, sainfoin	. . .	30 ,,	,,	30 ,,
15 ,, meadow	. . .	80 ,,	,,	60 ,,
		280		300

Of course the 60 tons of grass produce put down to the column of winter food is given as hay, but that does not affect its valuation as food. Here, then, by so much arable produce we might be able to provide daily food throughout the year equal to the maintenance of a herd of 20 to 25 cows on a poor farm of 50 acres. A medium farm of 50 acres wholly of pasture would not, as a general rule, keep more than two-thirds of the stock for which food is thus provided. The crops supposed are heavy, but land liberally cultivated under such a rotation ought to yield good crops.

(2.) The following is the case of a dairy farm of 35 acres of meadow and 25 acres of arable land.—The cows are stall, box, or shed-fed during winter and during part of spring and autumn. Suppose them to be under shelter

200 days in the year. Each cow must have about 8 lb. of litter daily; she may be kept comfortable with this, though it is certainly a scanty allowance; she will thus require 14 cwt. per annum, and 25 cows will need about 17 tons a year—a quantity which may be supposed to grow on 12 acres, the half of the arable land.

The arable land, then, may be cropped thus:—

1 acre of lucerne.
12 acres of grain crop, or 6 of wheat and 6 of oats.
6 acres (after wheat)—2 of rye, 2 of Italian rye-grass, and 2 of vetches. These again succeeded by 6 acres of mangold wurzel.
6 acres (after oats)—1 of parsnips, and 5 of carrots.

Of the pasture land:—

18 acres may be mown, and
17 acres depastured, each year.

The following, accordingly, will be the produce of green food, besides the straw of the 12 acres of grain:—

18 acres of hay, equal to 30 tons of hay; which may be considered equal in green food, to	120 tons.
18 acres of aftermath, equal to	60 ,,
17 acres depastured, equal to	190 ,,
1 acre of lucerne, equal to	10 ,,
2 acres of rye, equal to	15 ,,
2 acres of Italian rye-grass, equal to	25 ,,
2 acres of vetches, equal to	20 ,,
6 acres of mangold-wurzel, equal to	170 ,,
1 acre of parsnips, equal to	10 ,,
5 acres of white carrots, equal to	60 ,,
Or, in all	680 tons.

a quantity equal to nearly 2 tons of green food a day, which will keep 30 to 35 cows very well. And the crops may all

be used in proper season. Beginning with October; till January, the cows will be feeding on grass, carrots, parsnips, and hay; till April, on carrots, mangold wurzel, and hay; till June, on mangold wurzel, rye, rye-grass, vetches, and hay; during summer, on grass in the fields, lucerne, &c. The only difficulty will be in getting the wurzel after Italian rye-grass and vetches; this must be done by spade; and if each day, the piece mown be manured, dug, and planted with young plants from a seed-bed, I do not anticipate much difficulty. In addition to this stock, two horses will be kept, and food must be provided, or displaced, for them by the purchase of 40*l.* worth of oats, meal, &c. It is plain that other crops might have a place in the scheme. Cabbages which admit of transplanting in a forward stage of growth from seed beds to any land from which the crop has just been taken will be certain to have a place on such a dairy farm.

These instances will be considered cases of high farming; and the ordinary experience of dairy farmers, where only one cow is kept to every 3 or even 4 acres of pasture, is more generally improved upon in a less vigorous way by the cultivation of a few acres of roots, so as to economise the winter's consumption of hay, render less hay-making necessary, and make more acres of the pasture available for summer feeding; thus enabling the keeping of more cows on summer feeding of grass, which is the most productive of milk.

A large produce from the cabbage might be obtained by two crops being taken in rapid succession from the same land, viz. a crop of an early sort, planted as soon as the mowing of the vetches allows the land to be manured and worked; and then a crop of the larger "Drumhead" sort dibbled

in, as every fourth of the early cabbages is cut in spring, leaving the removal of the others to be effected during the months of May, June, and as they are required; the intervals between the then growing *field* cabbages to be dug and manured as they are thus cleared. Vetches, too, will need to be sown in successive patches, in order to yield a succession of food during the summer months. The difficulty of the autumn months, especially in a dry season, may generally be met by having the later cabbage crop in readiness; sometimes, also, by some early sown rape.

CHAPTER III.

CHOICE AND TREATMENT OF THE COW.

Dairy Breeds: Shorthorns, Suffolk, Jersey, Guernsey, Ayrshire, and Kerry—Individual Character: Age, Form, Other Characteristics—Treatment of Cow: Housing, Health, Winter Milk, Diseases, Milking—The Calf: Rearing and Feeding.

THE various breeds of cattle known to English agriculture, and their ordinary management, have been already described in a Handbook on the Live Stock of the Farm, but it is right that such peculiarities of breed, age, and individual character should be referred to, as ought to guide the choice of the purchaser.

The Dairy Breeds of Cattle.—Of the many distinct breeds of cattle cultivated in the United Kingdom, only four or five can be enumerated as strictly dairy breeds. Among these are the shorthorn, the Suffolk, the Channel Island breeds, the Ayrshire, and the Kerry.—(1). *The Shorthorns* are more and more the principal dairy breed of these islands. In Gloucestershire there was, and still is to some extent, a dark red, or brindled cow, of medium size, with almost black extremities, though sometimes with a streak of white along the back: but it is now becoming rare. In Cheshire also there was a native breed more or less resembling the Lancashire and midland counties long-horned breed; but either by substitution or by crossing,

the Yorkshire cow, essentially a shorthorn, is displacing it. This therefore is at present peculiarly the milk-producing breed of the country. In the midland counties the long-horned breed does indeed still retain its place in dairy herds, and yields well enough to justify its retention. Elsewhere the Devon, a much smaller animal, yields but a small quantity of milk; the Hereford, an animal of nearly equal size, is also deficient in its yield, and in neither of these counties does the prevalence of a peculiar breed produce anything like a general dairy husbandry. The London milk dairies are thus almost exclusively of this short-horned Yorkshire cow, and excepting Suffolk, Ayrshire, and the Channel Islands, it is extending more or less into every dairy district of the country. It has the advantage over all other sorts, that its calves make more valuable oxen, and its cows, after five or six years' milking, are more easily turned into beef. The milk, compared with that of other smaller breeds, is remarkable rather for quantity than quality, and therefore it is adapted either for direct consumption, or for the production of cheese, rather than of butter. For this reason, while taken for town dairies, and for the cheese-producing districts, the Ayrshire or the Channel Island sort are preferred by those who merely wish a home supply of dairy produce for the house. Good shorthorn cows are now offered for sale in almost every considerable market in the kingdom. The northern fairs, however, as those of Yarm, Northallerton, Darlington, and Newcastle-on-Tyne, furnish the best choice. The fairs of Northampton, Boston (Lincolnshire), Stow-in-the-Wold (Gloucestershire), are also noteworthy. The best young cows just calved are worth from 20*l.* to 25*l.* apiece: prices, however, varying from year to year.

(2.) *The Suffolk*, a hornless red breed, is of great excellence for the dairy. Like all good dairy animals, its cows are narrow and small before, compared with the development of the hind-quarters. They are good milkers, and as the Suffolk dairies are mostly managed for the production of butter, the milk is of tolerably good quality. The Suffolk breed yields probably a larger quantity of milk in proportion to its size than any other in the island, and it deserves therefore more attention, as furnishing suitable animals for small home dairies, than, except in its own district, it has received. The polled Suffolk cow is purchasable at almost any of the fairs in Suffolk and the adjoining counties.

(3.) The *Jersey* and *Guernsey* breeds, in which, faults as a fattening animal, and merits as a milk producer, generally both in an exaggerated form, are combined, are the favourites of the small or household dairy. The great, almost deer-like beauty of the head, and indeed, in well-bred Jersey cattle, of their whole form, makes it an ornament to the park; the unequalled richness of its milk enables it to meet a demand for cream; and its small size makes it at once less mischievous in winter in the field, and more easily managed in the house. The quality of its milk is so good, that not unfrequently one (or more) of this breed is kept even in large dairies, where the large-framed Yorkshire cow forms the majority of the herd, for the sake of the enrichment of their produce by the mixture of its own. The best fair at which to purchase Channel Island cows is that held on Trinity Monday at Southampton. Sales by auction are, however, almost weekly advertised in the London papers, where these, and other imported breeds, are offered. The price reached is 20 guineas, and higher,

for a well-bred young cow. The fawn-like Jersey has an equal rival in the yellow and white Guernsey, a larger cow, yielding as much or more milk of an equal quality, with a frame and character better calculated either to carry beef or to admit of crossing with other beef-producing breeds. Mr. Hosley, of Audley End, near Saffron Walden, has lately published the results of three years' records of dairy yield in Lord Braybrooke's Jersey herd. The average yield of cream over the entire herd in 1882, 1883, and 1884 has been 15·5, 15·8, and 14·7 per cent. of the milk respectively; the highest in any cow was no less than 33·0, 32·0, and 32·5 respectively. The yield of butter from milk varied from 5½ to 17½ ounces per gallon in different cows, the average being 9, 9½, and 8½ ounces per gallon over the whole herd in the three years; the milk to a pound of butter on the average was 7, 6¾, and 7½ quarts in 1882, 1883, and 1884 respectively; and the total yield of milk we have already reported as varying from 750 to 3600 quarts per annum. It is plain that a breed, of which this is a possible record, must possess the very highest dairy value.

(4.) *The Ayrshire*, though too small for the productive pastures of our English dairy districts, and involving, owing to the greater number that must be kept on a given extent of ground, more labour than the larger dairy breeds there prevalent, is one of the most useful dairy animals we have. It possesses more perfectly, perhaps, than any other sort, the external features which a good dairy cow ought to exhibit, and withal, it displays a greater aptitude to fatten than other small dairy cattle generally have. It yields a remarkable quantity of excellent milk, which, if less rich than that of the Guernsey or Jersey cow, is better adapted

for cheese-making. It is generally short-horned, red and white, small boned, and with light forequarters. Good Ayrshire cows are to be obtained at all west of Scotland fairs and markets. The best bred animals have a "fancy" price, and as much as 18*l.* to 20*l.* are asked for good young cattle in milk.

(5.) *The Dutch*, a large black and white breed, large horned and somewhat ungainly in appearance, is now in great repute both in this country and America for their large yield of milk, which, however, is of poor quality.

(6.) *The Kerry* breed of cattle are remarkable for their small size, and comparatively with it their large yield of extremely rich milk. This character they possess in common with other small and mountain breeds of cattle. The Anglesea breed, for instance, a small race of black cattle, are spoken of as deserving more attention for the dairy than they receive. And the small Breton cow is another of the same class, which is being imported in considerable numbers for household dairy use. None of these small breeds are, however, comparable with the Ayrshire, the Suffolk, or the Channel Island cow for such purposes, and still less can they compete with the two first named, or with the shorthorns, for use on large dairy farms.

Age and individual Character.—It is these, of course, and chiefly these that must guide the purchaser of a cow. The breeds that have been named will guide a choice, simply because in them individual character does receive, to a certain extent, a classification. Thus, the characteristics of a cow embrace such particulars as size, docility, form, aptitude to fatten, and proved productiveness

as to milk; but the cows of any given breed more or less resemble one another in all these points, and a reference therefore has been made to those particular breeds in which, as regards fitness for the dairy, the combination of all these qualities is best. It is, however, the actual possession of these characters in the individual, and not its belonging to a dairy breed of acknowledged excellence, that constitutes its merit; and it may be well, therefore, to point out those particulars with which excellence for the dairy is generally connected. (1.) As to *age*,* there is nothing more unprofitable than an old cow. In the ordinary practice of the dairy, the cow is kept probably five or six years in milk, being sold when eight or nine years old; this is the general practice, simply because at that age the quantity, and especially the quality, of her milk falls off so much, that it is better to replace her with a younger animal; but as a cow is sometimes of such first-rate quality as to induce her owner to keep her as long as she will breed, so oftentimes it is well to part with an inferior cow after a year or two's experience of her. The cow is generally at her prime after her third calf. In Ayrshire, when cows are let to dairymen, three heifers with their first calf are put as equal to two cows. (2.) As to *form*, a good cow, of whatever size, is generally lighter in her forequarters than behind; she should be especially wide and deep at the loins, her skin should handle soft, her udder should be of full size, and the teats should be placed symmetrically on it, and it should be ascertained that they are all perfect—that the cow has not,

* For indications of age, and many other particulars not specially called for in a Handbook of Dairy Husbandry, see "Handbook of the Live Stock of the Farm"—(Messrs. Bradbury and Agnew.)

as it is said, lost any of her "quarters." * The milk veins in connection with the udder should be prominent and large. The head should be rather long and narrow, and the neck rather thin than otherwise; the extremities generally should be fine. (3.) Among *other characteristics* of a good dairy cow, quietness and docility of temperament is a point of capital importance. A notice here, too, may be given of what is regarded generally as a curious speculation, rather than as having any certain foundation in experience. M. Guénon, of Bordeaux, has professed to be able to determine the quantity of milk which a cow will yield, and the number of months during which she will maintain that yield, by an examination of certain local marks on the thighs and hinder part of the animal. The notion is, that cows are good milkers in proportion to the extent of surface on the thigh, and backside generally, which is covered by reversed hair. The farther upwards, and the wider there, that this surface of upward growing hair extends, the better is the cow as a milker. An attempt is made to connect this "escutcheon," as it is called, surface with the arterial arrangements for the supply of blood to the milk-secreting apparatus within the udder; but M. Guénon's theory, such as it is, does, we believe, depend simply upon the alleged observation of good milking qualities in animals which exhibit this peculiarity in a remarkable degree. The late Mr. Haxton in his book,

* This would really constitute a loss of one-quarter of her milk; for the udder is not a bag from which the teats are four common outlets for the fluid it contains. Each of these outlets has connected with it a separate apparatus for the secretion of milk; so that, on the one hand, if one fail or be diseased, wholesome nourishment for the young may still be obtained from the others; but so also on the other, that the loss of a teat is equal to a real loss of one-fourth the milk-producing ability of the animal.

entitled, "How to choose a good Milk Cow," * declared that his own examination of many dairies, expressly for the purpose, led him to the conclusion, that M. Guénon's marks of a good milk cow are really trustworthy.

Treatment of the Cow.—The proper treatment of the cow in milk, which has been separated from its calf, consists simply in giving it suitable food and water at regular times, allowing it sufficient exercise for its health, keeping it clean and warm, and milking it properly and regularly. The subject of food has been already sufficiently discussed, and the necessity, especially when comparatively dry food is given, of an ample supply of water being allowed, has been insisted on. Where the animal is house-fed, it should be fed on succulent and dry food alternately, and at least three times a day, allowing ample intervals for rumination. In any case she should be allowed access to a pasture or a yard for exercise during the middle of the day in winter, and early and late during summer. But it is of course much the better plan, where possible, to have daily access to the pasture field for food as well as exercise all round the year. (1.) The *cow-house* may be a mere shed with a trough along its inner side, and upright posts every 6½ feet or thereabouts, carrying a sliding ring and neck strap, by which two cows are attached each to its place; this shed should be open to the south, and be partly closed against the weather by wattled gates, or otherwise, in winter. Or it may be a series of "boxes," which may be 9 feet square, or 8 feet by 10, in which the cow remains during the winter season, being littered daily,

* Blackie, Glasgow.

rising in her lair by the continual addition of the hard trod straw and excrement. The trough in this case must be capable of being raised as the floor of the box rises, and if it be hung on two pins at each end between two uprights bored every three inches or so to receive these pins, this raising can be easily effected; and there will be this additional advantage, that by withdrawing the upper pin at either end after the food has been consumed, the trough will turn over bottom upwards, so as to hinder the cow from dirtying it. If the cow be confined permanently in this way, water must be "laid on" to troughs to which the cows have access. Much the most common cow-house, however, is that in which a double row of cows is tied in couples to a long manger at either side, leaving a wide interval in the centre enabling the easy removal of the dung and the easy bringing in of litter. A sufficiency of this for warmth and cleanliness must be provided; 10 to 15 lbs. a day apiece will be needed in the boxes: rather less will suffice for stalls. Except in box-feeding, the dung should be removed at least every morning and evening, and fresh litter supplied at night. It is an additional security for cleanliness, and a comfort and advantage to the animals, if they are occasionally curry-combed. The cows stand in couples between posts 6½ feet apart, and the lair, wide enough to give ample standing room when the cow is feeding at the manger, should have a wide gutter along its further edge to receive the dung and urine. In all cases ample space and sufficient ventilation should be provided, and at all times, of course, kind and gentle treatment must be insisted on. An animal so sensitive as a cow, whose produce is dependent so much upon its health and even temper, abundantly rewards quietness, and punctuality, and

liberality of treatment. On the subject of patience and gentleness in dealing with the cow, it may be well to add, that they are especially needed in dealing with a heifer rearing her first calf, and just commencing to be milked.

(2.) *Health.* The cow goes with young 9 months and a week, or thereabouts. Of 760 cows, whose period was observed by Lord Spencer, 600 calved between the 279th day and the 291st day, and the births were pretty evenly distributed over the intervening period, reaching a maximum about the 284th day. 314 cows calved before the 284th day, and 310 cows calved after the 285th day; and it is noteworthy that a larger proportion of bull calves came at late births, and a larger proportion of cow calves at the earlier births. Thus of 381 calves dropped after the 284th day, 233 were males and 148 females; and of 294 calves dropped before the 284th day, 135 were male and 159 were female. On the whole, the number of males produced by this very large number of cows was considerably above that of females.

Of abortion it must suffice to say, that while sometimes owing to ill-health at the time of its occurrence, it is probably often produced by eating ergotted grass in autumn; and as a security against this it is well to let the cows run rather on aftermath at that season than on imperfectly grazed pasturage where bents and seed stems of various grasses are generally found exhibiting the ergotted condition.* In the ordinary practice of our dairy districts,

* Ergot is a diseased state of the seed of rye and certain grasses—a malformation of growth, owing to the attack of a parasitic fungus. It is a popular belief, generally ridiculed, however, that the keeping of a donkey or a goat with the herd will hinder this slipping of the calf. It is possible that a preference of this animal for the drier bents liable to ergot, may be at once the explanation and the justification of this belief.

where it is desired that the cows be in full milk, and their calves all, or nearly all, weaned by the time they turn out to grass, it is common to let the bull run with them from the end of May, or thereabouts.—*Winter Milk.* When a constant supply of milk, required whether for the market or for merely home use in a household, is to be supplied continuously throughout the year, it is necessary either to have a summer and a winter cow, by giving them access to the bull in summer and in winter respectively, or to change the cow at a considerable loss, when she begins to dry, for one more recently calved. The cow should be let dry at least six weeks before calving, and two months is a better time. Simply ceasing to milk it is sufficient for this purpose. If you give it somewhat drier food and less water for a few days, the secretion of milk soon ceases; but if any swelling or inflammation of the udder ensues, hot fomentation is a sufficient remedy. The parturition of the cow takes place generally without the need of any assistance, but in case of difficulty a properly qualified practitioner must be called in. Before calving, and immediately afterwards, the cow should be carefully nursed, and receive warm mashes twice a day with her usual food; and these are made simply by pouring boiling water over bran—a peck or thereabouts at a time—letting it remain until cold enough to give it as food. Steamed turnips may be mashed up with it, and a pint of oatmeal mashed in will make it still more nourishing. —In calves the "*hask*" or "*hoose*," a cough produced by worms in the windpipe, is prevented by good water and sufficient food; and may possibly be cured by limewater, "half a pint daily," or turpentine in linseed oil, "one ounce in four, once a week." This should be taken along

with entire change of food, as, for instance, removal to old sainfoin in an upland district.—*Quarter-ill* is another disease of young animals, producing almost sudden death, often owing to sudden change of food or exposure to cold. It is best prevented by uniform treatment as to feeding, and warm and comfortable housing.—*Hoven*, in which the stomach is distended by the gases produced during imperfect digestion, is the consequence of greedy or rapid feeding on succulent food. An ounce of hartshorn in a pint of water will greatly relieve; if not, the left flank is sometimes stabbed downwards between the hip bone and rib, and the gases liberated—a "trochar," leaving a "canula" in the wound allowing the passage of the gas, being used for the purpose.—*Purging* in calves is generally treated by a dram or two of carbonate of soda given in warm milk, which helps to dissolve the indigestible curd in the stomach. Two ounces of mutton fat dissolved in a quart of warm milk is sometimes given to a calf thus affected, with good effect; in cows, chalk and opium are the remedies.—*Redwater* is a disease of the liver, accompanied by scouring, and dark-coloured urine; the medicine should contain calomel and Epsom salts.—The *drop after calving*, a paralysis, is to be prevented by allowing the cow sufficient exercise, and keeping her in good health before calving.—The *foot and mouth disease* is accompanied by sore feet and blistered mouth. The mouth should be washed with alum-water and treacle, and the cows should be carefully nursed, and fed if necessary on linseed mashes, gruel, and other soft food.—*Pleuro-pneumonia*, an infectious disease of the lungs, may possibly be cured if taken at the earliest symptom, commencing as it generally does with "a little short cough, and staring

coat." In addition to medical treatment, good nursing and linseed mashes as food are required.—*Diseases of the skin*, as mange and lice, are to be avoided by cleanliness and curry-combing, also by good feeding, which keeps the animal in vigorous health, and able and willing to clean itself; and they may be cured by thoroughly rubbing in tobacco-water.—When owing to any wound or disease in the teat blood appears in the milk, the teats should be well fomented with warm water, milked with gentleness, and the following ointment afterwards applied to them,—"Palm oil 3 ozs., yellow wax 1 oz., acetate of lead 2 drs., alum 1 dr. To be well incorporated together, and applied daily after milking."—Warts on the udder, which are often a great nuisance, are removable "simply by the knife or cautery, or ligature when the cow is not in milk." It must suffice to add here, that for these short notices, the value of most of which has been verified in our own experience, we are indebted to Mr. W. C. Spooner; and we conclude as we began, by advising that, except where mere nursing will suffice, the veterinary surgeon be consulted.

(3.) *Milking.* On the right performance of this operation depends a good deal of the produce which it obtains. It should be effected gently, quickly, and perfectly—the first because everything that soothes the animal is beneficial, the last both because the milk-secretion is thereby unchecked, and because the last-drawn milk is much the richest. The whole subject, however, was so well treated in a paragraph which appeared some years ago in the *Ayrshire Agriculturist*, that we extract it here:—

"The milking of cows resolves itself naturally into two heads, viz., how to milk, and when to milk.—If every drop of milk in the cow's udder be not carefully removed at each

milking, the secretion will gradually diminish in proportion to the quantity each day left behind. But another reason why every drop of milk should be taken away is to be found in the well-known fact, that the last milk is doubly as good as the first milk—hence, if not removed, there is not merely equal, but double loss. Milking should be conducted with skill and tenderness—all chucking or plucking at the teats should be avoided. A gentle and expert milker will not only clear the udder with greater ease than a rough and inexperienced person, but will do so with far more comfort to the cow, who will stand pleased and quiet, placidly chewing the cud, and testifying by her manner and attitude that she experiences pleasure rather than annoyance from the operation. Cows will not yield their milk to a person they dislike or dread. The ordinary practice is to milk cows twice daily—at about 5 o'clock in the morning, or in winter as soon after daylight as possible, and again at the same hour in the afternoon, thus leaving 12 hours' interval between each milking."

It should be added, that cleanliness in milking should be observed—the hands should be clean and the udder too. In practice the milkers wash their hands, but not the udder of the cow; and a clean milker, that is, one who does not wet his hands with the milk when milking, will milk a dry udder without dirtying the milk, even though the udder be not clean. In large dairies milking lasts about an hour each time, and 8 or 9 cows are allotted to each man.

The Treatment of the Calf, when intended for veal or for beef, has been already to some extent discussed.*

* See Handbook of the Live Stock of the Farm. Bradbury, Agnew, & Co.

When the heifer calf is reared for dairy purposes, less forcing food is required and even desirable. Ample exercise, too, is necessary. The rules to be observed are to give the milk, whether it be new or skimmed, of the natural temperature, to be obtained by warming a portion of it before mixing with the rest; and perfectly sweet; to take care that calves are brought into shelter at night, at least till June and again after September, and to keep them few together in the field. After a few days they are fed from the pail, by getting them to suck the fingers under the surface of the milk; giving them at first two quarts a-piece in the morning, and two quarts a-piece at night; and it is well to tie them up for the purpose, and to let them remain tied up for twenty minutes or more after being fed, else they take to sucking and plaguing one another. A little hay in a network bag is hung here and there in the calves' house, that they may learn to suck and eat it. During the first winter, a little hay is given along with turnips and mangold wurzel and a little bit of oilcake daily benefits them. The ensuing summer is spent in second year's clover, or old sainfoin as pasture, and in the case of the more precocious breeds, they are often put to the bull at sixteen months old. They are fed during their second winter on a full allowance of roots and straw with a morsel of good hay or oilcake in addition. To keep up a herd of dairy cows, about one fifth their number of heifer calves must be reared each year; these are almost invariably selected from the calves of the herd, the remainder being sold as soon as possible after birth. If, however, it be desired to rear heifer calves for sale as young cows, it is good policy to purchase them from the best dairies, even though you pay 3*l.* a-piece for what elsewhere would not

cost one half as much. Taking them in succession, a couple at a time, and eking out with hay tea, and meal, and linseed, ten calves may very well be reared in the course of the season on the milk of a single cow. It is well to leave the calf with its mother for a week or two in the case of young cows; they are better milked by their young; and if carefully stripped in addition at least once a day by hand, are likely to yield more milk, and to yield it more easily in the future than if the calf be taken early from it, as it may from older cows.

It is proper that mention should be made here of the various artificial calf foods, by Messrs. Bowick, Messrs. Bibby, and other manufacturers, by which the use of milk in calf feeding may be economised, and by which skim milk may be enriched. Ample experience exists of their efficiency for this purpose: and of the saving which they enable the farmer to make. The use of hay tea, too, has long been known as a great help in economical calf rearing.

CHAPTER IV.

MILK.

Composition—The Dairy—The Taste of Milk—Adulteration.

The Composition of Milk.—Milk is essentially an emulsion of oily matters in a water containing albumen and casein (cheese) and a sugar in solution. Its oil floats in it in the form of globules, varying from $\frac{1}{2000}$th to $\frac{1}{4000}$th part of an inch in diameter. If the milk be kept at rest, these globules will rise to its surface and form a coating of cream in which, along with still a portion of water holding various substances in solution, they form a fluid which upon being violently agitated, thus rupturing the globules and enabling them to unite, separates into the butter which these form, and the "butter-milk," containing water, casein, sugar, &c., which they leave behind. The composition of milk, in so far as these buttery globules are concerned, is ascertained in a rough way by an instrument called a lactometer or lactoscope. In one form it consists of a glass tube five inches long, held upright in a frame and graduated downwards in a scale dividing the contents below the zero mark into 100 parts. On being filled up to the zero mark and left at rest the mechanical separation of the buttery globules (cream) takes place, and the quantity of this cream in 100ths of the whole quantity of

milk may be read off upon the scale by the thickness of the layer which it exhibits. A series of such tubes in a frame are needed for comparing in this way the milk of different cows.

Another instrument, for the same purpose, depends for its indications on the fact that opacity of milk depends upon the corpuscles of fatty matter which are suspended in it, and that consequently the more cream it contains the greater will be the obstacle opposed to the passage of light. It consists of two tubes, one of which may be pushed into the other like the joints of a telescope, and the end of each tube is closed with glass, so that when milk is poured into the outer tube by a small opening on the side, by pushing in the inner tube, a layer of milk of any thickness may be obtained. The apparatus is placed on a stand, and the value of the milk is estimated by the thickness of the layer of it through which the light of a small wax taper at a fixed distance can be observed, the value of the milk being in the inverse ratio of the transparency; for the larger the amount of fat present, the greater, of course, will be the opacity. The thickness of the layer of milk is measured by a scale on the instrument, and a table sold with it shows the percentage of cream to which it corresponds.

These and other devices are expedients for determining by mere observation the relative quality of different samples of milk. For the exact determination of its composition a tedious process of analysis is required, on being subjected to which it is shown to consist of casein, butter, sugar of milk and water, besides soluble and insoluble mineral matters. The quantities of these in a sample of milk vary very considerably.

The milk of different animals varies in composition, as will be plain from the following table.

Ingredients in 100 parts.	Composition of Milk.									
	Woman.			Cow.		Ass.		Goat.	Ewe.	Mare.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Casein . .	1·54	1·52	2·9	4·0	4·48	1·7	1·82	4·08	4·50	1·6
Butter . .	4·37	3·55	2·3	4·6	3·13	1·4	0·11	3·32	4·20	trace.
Sugar . .	5·75	6·50	3·8	3·8	4·77	6·4	6·08	5·28	5·00	8·7
Ash . .	0·53	0·45	—	0·6	0·60	—	0·34	0·58	0·68	89·6
Water . .	87·81	87·98	91·00	87·0	87·02	90·5	91·65	86·50	85·62	
Total . .	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·06	100·00	100·00

Of these analyses, 1 and 4 are by Dr. Lyon Playfair; 3 is the average of 2 analyses by Haidlen; 5 is the average of 5 analyses by Peligot; and 2, 5, 7, 8, and 9 are by Henry and Chevallier.

As regards the milk of the cow, it differs in composition, as has been already said, according to the breed, age, and food of the animal. It also varies exceedingly according to the period since the birth of the calf. Thus, the first-drawn milk produced during the labour and excitement of parturition contains an extraordinary quantity of casein, and is otherwise different from ordinary milk; no doubt naturally beneficially so to the young in the first day or two of its life, during which time the milk not used by it and drawn from the cow is unfit for any other use, and is thrown to the pigs' trough. If this "colostric" condition, as it is termed, of the milk be prolonged, the purgative effect, beneficial at first, which it produces on the calf, becomes injurious. Too generous feeding after parturition, we are informed by Professor Simonds,* tends to the

* Vol. XIX. of the Journal Eng. Agr. Soc.

maintenance of this relaxing condition of the milk. And he also remarks that a period of rest from milking before the next birth is necessary in order that time be given to the milk-secreting organs for the provision of the material to which the altered state of the milk is then due. How very much the milk is thus altered, is shown by analyses by Henry and Chevallier, who found in the first milk of the cow, ass, and goat respectively—15·1, 11·6, and 24·5 per cent. of casein: differing enormously from the figures given above. The following table gives the results of numerous analyses of ordinary cow's milk:—

Ingredients in 100 Parts.	Composition of New Milk.									
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Casein .	3·32	4·22	4·0	4·48	4·16	3·42	3·31	2·94	5·1	3·6
Butter .	3·99	4·92	4·6	3·13	3·70	2·29	7·62	1·99	3·0	4·0
Sugar . .	5·01	4·16	3·8	4·77	4·35	2·79	4·46	4·48	4·6	5·0
Ash . .	0·22	·55	0·6	0·60	·59	·52	·71	·64		
Water .	87·46	86·15	87·0	87·02	87·19	90·42	83·90	89·95	87·3	87·4

Of these, No. 1 is the average of 10 analyses, by Boussingault, of milk from cows about 200 days after calving, and fed upon the whole on rather poor rations. No. 2 is the average of 8 analyses, by Playfair, of autumn milk, from a shorthorn cow, whose period of calving was not known; she was fed on rich food. No. 3 is another by Playfair, "the average of several analyses taken when the cow was in the field." No. 4 is an analysis by Henry and Chevallier: 5 is by Dr. R. D. Thomson * of milk from grass-fed cows; and 6 is the average of two samples

* Thomson on the Food of Animals. Longman.

of remarkably poor milk supplied to the union workhouse, Belfast. Nos. 7 and 8 are examples of rich and poor milk respectively quoted in a recent lecture by Dr. John A. Voelcker; 9 is an analysis, at Giessen, by Haidlen; and 10 is the average of 12 analyses, at Bechelbronn (Alsace), by Boussingault.*

These tables, together with the intimation that casein, the essential matter of cheese, is soluble in alkaline solutions, and is so held dissolved in milk—that the butter of milk is a compound of several oily matters of different composition, and produced in various proportions, according to such circumstances as the food and the temperature of the period—that the sugar of milk is capable of transformation by the mere re-arrangement of its elements into a substance having acid properties, and therefore called lactic acid—that this re-arrangement is effected by almost any disturbance of a chemical nature, such as the presence of a ferment itself in process of decomposition—that, in fact, any substance in contact with it, undergoing chemical transformation, acts as a ferment on it, so that decaying matters in its neighbourhood, and air carrying filthy odours, the product of such decay, are thus ferment enough for the purpose—that the curd of milk itself, in the presence of warm air, thus undergoes such chemical transformations, and becomes a ferment—that rennet, itself a ferment [the word may stand, whatever theory of its action be adopted], deals with the solvent whatever it is by which the casein is held dissolved in the milk so as to release the latter, which resumes its form as curd insoluble in water:—These par-

* For 1, 9, and 10, see Boussingault's "Rural Economy." Others are taken from the Journal of the Agr. Soc., and Johnston's Lectures on Agr. Chemistry, and Dr. Thomson on the Food of Animals.

ticulars must for the present suffice on the subject of the composition of milk.

The preservation of milk in its natural composition, and therefore in its sweetness, may be effected by heating it in bottles or metallic vessels up to the boiling point, and then closing them hermetically. The air is thus expelled to which the chemical changes involved in the souring of milk are due; and, moreover, the curd which under the influence of air acts as the disturbing ferment, loses for a time, until again exposed to air,* its power of entering on these chemical changes after being raised to the boiling temperature. In this way milk is made capable of becoming an article of commerce, and will be acceptable as a drink after months of keeping. Condensed milk—which is milk subjected to evaporation so that more than one-half of water is dissipated, and the whole reduced to a thickened glutinous mass, to which in some cases sugar has been added—is now largely manufactured, and is especially serviceable for use on shipboard, where it will keep fresh for months.

For the period during which milk is kept for the separation of its cream, its sweetness is to be maintained simply by keeping it cool and in perfectly clean vessels and perfectly clean air. It is in this way that we avoid the operation of all external ferments, and hold in check the chemical alterations which they promote, to which the souring and other injurious changes in the condition of milk are due.

The Dairy.—In order to keep milk sweet, and for the proper management of the processes which its manufactured

* So that repeated heating of milk, nearly to the boiling point, at intervals of 24 hours, or thereabouts, will keep it sweet, though it be exposed to air during those intervals.

products undergo, certain rooms must be set apart expressly for the purpose. The milk-room should be cool, for the reasons just stated; and a somewhat sunken floor, a shaded or thatched roof, and an aspect to the north and east are therefore desirable.

In it there are shelves on which the vessels to contain milk are to be arranged. The shelf and the floor are better of stone than of wood, as being less absorbent of anything, whether milk or dirt or damp, which may act as a ferment. The room should be away from any drain or dungheap; it should not be near any store of food, whether the larder of the house or the feeding-stalls of the farmery. The air which enters it should, if possible, be free from the taint which any such neighbourhood more or less produces. The drier, too, the air is, the better: and therefore it is better that a dairy be kept clean by keeping out the dirt, by rubbing and by brushing, than by washing. Practically, however, the floor and shelves of the milk-room are kept clean by washing. By strict attention to cleanliness and ventilation, and by as far as possible excluding a summer temperature, those causes which tend to the souring of milk are excluded or held in check. And so it is made to yield good butter, and good cheese.

The Taste of Milk is affected by the food of the cows, and in its turn is communicated to the butter and the cheese made from it. In the latter case, if it can be artificially removed, this must be done before the curd is set: in the former case the attempt at removal is sometimes made after churning has been done. In both, however, it is best to attempt the removal of the aroma from the milk. It occurs in the milk of cows at pasture, some-

times when the buttercup is in full bloom, or when wild garlic has been eaten. It is, however, a more general difficulty during winter time, when cows receive turnips, cabbages, and mangold wurzel. In all cases, the best method is to attempt by heat to dissipate the aroma. This is to some extent possible, by cooking the food to which the taste is owing: a mess of steamed turnips and bean-meal, and oatmeal and linseed will produce perfectly sweet milk. But if after milking, it be found to possess the disagreeable taste, then if it be placed in hot water and allowed to steam for half an hour or so before placing it in the vessels in the dairy, the taste and smell will in great measure leave it. The following are among the devices our correspondents have adopted for the more thorough expulsion of the taste.

No. 1 has found chloride of lime very effectual to remove from butter the taste of turnips, or any other bad flavour. A drachm of it to every expected pound of butter is put into the water of the second washing, after it is taken out of the churn, and the butter well but rapidly kneaded in it.

No. 2 says: Do not feed your cows with turnips until they have been previously milked, by which means the animal has twelve hours to get rid of the flavour of the vegetable. Good hay must also be given in sufficient quantity. Great cleanliness must be maintained not only in the dairy but in the cow-house. No stale pieces of turnip should on any account be allowed to remain in the manger, which should be cleaned out before feeding.

No. 3 says: We had cows on grass last year, and their cream and butter had an acrid taste in the spring-time. We had about a dessert-spoonful of saltpetre dissolved in water, and put into every gallon of milk before it was

churned, and a small bit of common salt was put into the milk-pan when the milk was brought in from the cows. The cream was put to stand in boiling water for half an hour, and frequently stirred while the water cooled before it was churned. Ultimately we had good butter, but certainly not till after this season of the year had passed.

No. 4 recommends, that as soon as the milk is brought into the dairy (warm from the cows), there should be poured into it half a pint of boiling-water to every gallon of milk; cover it over with a cloth four times doubled for half an hour; then strain and pour it into milk dishes to stand for cream. The cloth will absorb the steam and entirely remove any unpleasant taste.

No. 5 has occupied a farm of 500 acres, and kept a large dairy of cows, and never had the taste of turnips in the butter. The application of hot-water and steam, at different times, to the milk and cream, entirely took away all flavour of the turnip.

No. 6 says: My butter is made from the milk of cows fed, morning and evening, on swedes: the only precaution adopted is that the cream, before being placed in the churn, should stand in a room with a fire, and raised to the temperature of 65° Fahr.

No. 7 says: If you collect so many gallons of cream before churning, put that number of half pints of vinegar into the jar to begin with, and churn when the usual quantity is collected.

No. 8 makes a strong solution of nitre, and adds a dessert-spoonful of it to every two gallons of milk as it is brought in from the cow.

No. 9 says: My cows were fed last winter on mangold wurzel cut into shreds with a Moody's (Frome) turnip-

cutter, and mixed with hay and straw-chaff. The butter was made twice a week, and was good in flavour, but crumbled. In the spring I was able to add rape to the above food, the butter immediately changed to a good texture, and improved in flavour; this change I attribute to the oily nature of the rape plant.—To this it may be added that there are many testimonies to the fact that pulping roots before giving them to cows does tend to dissipate their disagreeable aroma, and so to insure good milk.

No. 10 recommends the preventive system—it is better than the curative. If cows eat old and decayed grass in the meadows you cannot have good butter; if they get at strong-scented herbs the butter will partake of the smell; if the cream is mismanaged before and during churning, you must not expect pleasant butter; if your cows are too stale milked, the butter will be rancid. If cleanliness and attention to the diet of the cows be looked to, cases of failure will be very rare.

No. 11 asserts that turnip-milk will not keep so long as grass-milk, but gets rancid; and this is increased by the practice of keeping the churn near the fire in winter, which is sometimes done.

No. 12 says: When the cream is in the churn, and the proper temperature gained (57°), I put in a little chloride of lime mixed in a little water. Of course the quantity depends upon its pureness, and also upon the degree of taint. I put as much as will lie upon a sixpence to three gallons. One or two trials will ascertain the proper quantity. Too much gives a disagreeable flavour, a little improves it and gives a sweet nutty taste.

No. 13 has given his milch cows for fifty years turnips regularly in the winter, and both milk and butter have

been perfectly good. The turnips are swedes or Aberdeen yellows, and he takes them up in October and carefully cuts off every bit of leaf and root, and stacks them in a dry cellar in his cow-yard; if every bit of leaf be not carefully cut off it will taint the milk.

No. 14 says: Let the dairymaid, before going to milk her cows, place on the fire her kettle filled with water; and on her return to the dairy with the new milk, add to every gallon of milk a sixteenth, or half-pint of boiling water; stir both a minute or two, and after a short interval pour them out into the lead, earthenware, or (as the case may be) glass bowls. I practised this method the whole of last winter (and am doing the same now), when my cows had as many swede turnips as they could eat, and not the slightest trace of the turnip flavour can be discovered. The water must be boiling when added, or the experiment fails.

As an additional cause of distaste in milk, we refer to the so-called "bulling" of the cows, a periodical excitement, which disturbs the whole system, and seems to be the only explanation possible of some cases of bad milk and butter, especially of those which occur when the cows are first turned out to grass after calving.

Adulterations of Milk are confined to admixtures of water, or of portions of skim-milk. Adulterations of these kinds are still not uncommonly practised, as the records of our police courts abundantly testify. Under recent legislation all sales of food are presumed to be under the inspection of qualified analytical officers; and of milk, as of other articles, analyses are continually being made when there is reason to suspect dishonesty, under which any abnormal poverty of milk is immediately detected. And

when the quality, either as regards the percentage of cream or of total solids, is found to fall beneath a certain very moderate standard, the seller is liable to fine by the magistrate. Apart, however, from direct addition of water, the most general cause of the inferiority of town milk no doubt exists in the quality of the food. When grains and distillery wash are the main feeding they receive, the milk is poor, altogether apart from adulterations.

The mention above of the Inspector and Public Analyst reminds us of the Butterine, Oleo-margarine, and other artificial substitutes for butter and for cheese, which certainly, however, are no part of English dairy husbandry, and cannot, indeed, be sold as dairy produce without a breach of the law. We do not propose to describe the processes by which milk, deprived of its cream, and re-enriched by the addition of oils and fatty matters obtained from the fat of beef, is made to produce an artificial butter or an artificial cheese. These manufactured articles are, however, when cleanly made, perfectly wholesome food; and butterine, especially, is largely imported into England from Holland and America—and is being more and more consumed in this and other countries.

CHAPTER V.

BUTTER.

Composition—Cream—Churning—Implements for the Butter Dairy.

The Composition of Butter varies somewhat with the method of its manufacture. If made from whole milk or from scalded cream, it contains more cheesy matter than if made from cream in the ordinary way. And this is an important matter, not only as affecting its taste, but also as affecting its keeping properties, for it is to this cheesy part, and its activity as a ferment, that the tendency of butter to decay is chiefly owing. But the composition of butter also varies to some extent with the circumstances of its manufacture. Its essential part consists of various kinds of fatty matter, liquid and solid, and it is largely on the feeding of the cows, and the temperature of the weather, &c., that the proportion of these several oils present in the butter, and its consequent firmness or softness, depends. The following are among the published analyses of butter:—

Ingredients per cent.	Composition of Butter.		
	1.	2.	3.
Pure Fats	82.7	79.72	79.12
Casein	2.45	3.38	3.37
Water.	14.85	16.90	17.51

Essentially, butter is composed of solid and liquid fats, margarine and elaine, and in addition to these oils, there may be present in very small and varying quantity, a number of other substances, of fragrant, or, some of them, of fetid odour. They are derived from changes produced in the sugar of milk and in the oils of butter—processes accompanied by the absorption of the oxygen of the air—which are excited and maintained by the presence of the cheesy part of the butter, which is here most liable to be acted on by ferments, just as it is in milk itself.

Cream forms a proportion of milk, varying according to the richness of the whole fluid, and the poorness of the remainder. And there are as many proportions between the one and the other as there are instances in which the point has been ascertained.

The following is from a correspondent in Gloucester:—20 quarts of milk in hot weather yield 1¾ quarts of cream, or about 9 per cent.; and one-fourth more, or 11 per cent., in colder weather. In Mr. Williams' dairy, Co. Cork, the average of the year's milk produced 12 per cent. of cream—12 pints of cream and rather more than 5 lbs. of butter per 100 pints of new milk. The average yield of Mr. T. Scott's English dairies, quoted some years ago before the Agricultural Society, was 1 quart of cream for every 12⅕ quarts of milk, or little more than 8½ per cent. of a cream yielding 15 ozs. of butter per quart. In Mr. Horsfall's dairy, to which reference has already been made, the cream did not exceed 6½ per cent. of the milk.

Some of the differences thus observed are no doubt owing to original differences in the quality of the milk; but this last case is due to an extraordinary density of the

cream obtained; for the milk was of at least ordinary quality, while the cream was so rich as to yield 25 ozs. of butter per quart, the ordinary yield being not much more than half that quantity. These differences depend, as has already been said, on differences of breed and of individual character; on differences of the period after calving when the samples have been examined; and on differences of feeding.

The quantity of butter obtainable from milk, except when the whole milk is churned, depends, other things being equal, upon the perfect separation of its cream. To this end the milk is poured through a hair sieve for the separation of any hair or other dirt, into vessels, where it stands some four inches deep; and after standing 12 hours it is skimmed by a thin almost flat tin dish, containing holes through which milk flows easily, and cream with difficulty. It may be skimmed a second time in the same way after another 12 hours, the milk after the first skimming being shifted into clean pans and set there for the next; or the milk may be, and very often is, left 24 or even 36 hours before being skimmed, and then it may be either skimmed, or the milk is drawn off beneath it either through a plug, if it be a shallow leaden cistern, or through a syphon if it be of glass or earthenware.

Probably the greatest quantity of milk in this country is set for cream in leaden cisterns about 4 or 5 inches deep: the next commonest pan is of brown earthenware, white inside, some 21 inches across at top, and 4 inches deep or thereabouts, and a foot or more wide at bottom. Vessels of tinned iron of similar shape are also commonly used for the purpose. Glass milk-pans are now much in vogue; exceedingly clean, as dirt is so much more easily seen on them; they are more brittle than the earthenware.

The late Mr. Duncan, of Bradwell, near Stony Stratford, told us:—"When I first took to dairying on a large scale, I laid out 20*l.* in glass pans. On further acquaintance with them, I have come to the conclusion that they are the cheapest things (even at 4*s.* each) that a farmer can use; for they are washed, and wiped, and kept clean with 300 per cent. less trouble than 'leads.' My glass pans are about 20 inches in diameter: I do not like larger ones. They hold about 5 quarts each."

Besides these several materials, stone cisterns or vessels cut out of what are called milk stones in Derbyshire, or out of common slate, are in use in some dairies.

As to the asserted differences in the yield of cream from milk set in different kinds of pans, that must arise if the milk in each was of the same depth, from their influence respectively on the temperature of the milk.

Butter-making.—There are wide differences of management recently introduced into English dairy management from abroad. In the "Cooley" system milk is set in cylindrical vessels in ice-cold water; and there is thus an improvement in both the quantity and quality of the cream and in the rapidity of its separation. By means of the centrifugal separator cream is taken more thoroughly from the milk, as well as more immediately, than in any other way; and the quantity and quality of the butter are improved. To revert to ordinary management, however, let it be added to the above, (1) that each day's skimming, or, rather, the cream separated at each operation, at whatever interval it be taken, is commonly placed in the cream-crock, a vessel which may be of earthenware or tin; (2) that at each addition to the store in this vessel, and,

indeed, the oftener the better, the whole is mixed up together by means of a wooden stirrer kept there for the purpose; (3) that when the last skimming of the milk is accomplished, the remainder of skim-milk is either placed together in a large wooden tub, whence it is drawn for sale, or where it is set for cheese, either by itself or added to the whole milk of another meal, or it may at once be placed among the store of food for the pig; and (4) that as soon as the vessels are emptied in which the milk has been set for cream, they are to be well washed and dried and placed ready for the reception of the next meal of milk; the washing being done first with warm water, and then with swillings of cold water in the case of glass, earthenware, or tin—and with water and wood-ashes scoured to and fro over the surface, and abundant swillings with cold water in the case of leaden cisterns. This completes the case of milk and cream management under the ordinary plan.

In Devonshire the milk is set for cream in tinned vessels or pans of iron or brass, of more than the common depth of milk-pans; and after 12 hours' standing or more, these are placed upon a furnace till the first steam is seen in blisters under it, after which they stand till the milk is cool, and then the cream is collected with a skimmer in the usual way, or it may be even lifted with the hand. It is kept thereafter in the cream-crock for a few days, or until enough is gathered, when butter is easily made from it by "flapping" it, as it is called, with the hand in a tub for about ten minutes or less. In some cases these tin vessels are never moved when full of milk, but placed upon the horizontal flue of a furnace which serves as shelf. After 12 hours' standing the fire is lighted, and the milk heated

until the cream blisters, when the fire is withdrawn and the milk cools, and in another 12 hours is ready for the separation of its cream.

The best maxims for the guidance of the butter dairy which have yet been published are those given in the tract entitled "Hints on Butter-making," * by Mr. H. M. Jenkins, the Secretary to the Royal Agricultural Society of England, of which extracts are here given :—

Clean all dairy utensils.

Cool the milk directly it is brought into the dairy, by placing the cans in a running stream, or by any other available method.

Set the milk, at a temperature not exceeding 55°, in glazed earthenware or tin pans.

Skim the milk carefully with a perforated tin saucer after it has stood twelve hours, carefully taking cream unmixed with milk. A second skimming of cream, twelve hours afterwards, should not be added until immediately before churning, and the most delicate butter is made with the first skimming only.

Keep the cream, until the time for churning, in the coldest place available if sweet-cream butter is to be made; but if sour-cream butter for keeping purposes is to be made, the cream should be gently warmed to about 64° Fahr., and the souring process commenced by the addition of a little sour cream or buttermilk. Sweet-cream butter is better for immediate consumption, as fresh butter, but it does not keep well, and the percentage of butter obtained from a given quantity of sweet cream is 3 to 4 per cent. less than from the same quantity of sour cream. Covered earthenware or tin vessels should be used.

* "Hints on Butter-making." Published at 12, Hanover Square, London.

Churn the cream at a temperature of 57° to 60° in a revolving barrel or a midfeather churn, fitted with a spigot. The more simple the churn the better, because it is more easily cleaned. The churning should be done with regularity, at the speed which experience recommends.

Ventilate the churn frequently during the first ten minutes by removing the ventilating peg for a few seconds.

Listen attentively to the sound of the cream, and when it changes in the least degree stop the churning, and ascertain whether the butter has come, and if it is in globules no larger than a pin's head, withdraw the butter-milk. To avoid loss, pass the butter-milk through a hair-sieve, which will retain any particles of butter that may escape with the butter-milk, and return them to the churn.

Wash the butter thoroughly with cold water by half filling the churn, giving it three or four turns and then withdrawing it in the same way as the butter-milk. Repeat the washing until the water comes out of the churn as clear as it was when it was put in.

Take out the butter with a pair of wooden patters or a hair-sieve, and do not touch it with the hand.

Press out the water still in the butter by passing it under a kneading board, or by working it gently with the wooden patters. Care should be taken not to destroy the "grain" of the butter by careless or superfluous working.

The butter "comes" first, as we have said, in flakes and particles, which are washed, as already stated, by successive additions of cold water; and at length, becoming united by the continued revolution of the beaters, form lumps, when churning may be stopped. These lumps are taken out by wooden patters and pressed together. The rule now is to avoid handling it directly, but till lately the dairy-

maid having previously well rinsed her hands and arms in cold water, and rubbed them with a little salt, placed the whole mass either in a pan of cold spring water to harden, or when no washing had been allowed, in a shallow empty wooden vessel. In the latter case the butter was repeatedly kneaded with the thick part of the open hand, and the butter-milk separated by this pressure, and mopped up as it appeared, with a canvas cloth which should be constantly wrung dry. On the thorough separation of this butter-milk depends a good deal of the keeping and sweetness of the butter; and though it involves more labour, it can be done in this dry way by perseverance in kneading and beating it with the cloth, and then mopping up the milky liquid. The whole process is, however, now accomplished by a revolving kneading apparatus referred to in a following paragraph. When washed, the milk can with less labour be equally well separated; but excessive washing of butter certainly separates some of that to which the fulness of its flavour is due. If the churning is done too rapidly, the buttery parts sometimes are not sufficiently viscous to cohere, and the butter assumes a granular texture, which renders it difficult to mould. The same fault sometimes arises in the case of cream from the milk of cows that have long calved. After a sufficient kneading or washing with cool hands, finely powdered salt is added to it, according to taste, certainly not more than 3 or 4 ounces per stone, and well mixed with it by the hand; the whole is then divided out in half pounds, and made into rolls, lumps, or prints, as the case may be.

In the curing of butter, the object is to bring every particle of the caseous ferment, present more or less in all butter, into contact with salt, or sugar, or substances

of that class, and so check its own tendency to decay, and its consequent action on the butter itself. It is important, therefore, to bring about the entire and thorough mixture of the salt with the butter.

We may add here the following recipe for "boiled butter," a form in which butter is preserved in Piedmont: "Into a clean copper pan (better, no doubt, tinned) put any quantity of butter, say from 20 to 40 lbs., and place it over a very gentle fire, so that it may melt slowly; and let the heat be so graduated that the melted mass does not come to the boil in less than about two hours. During all this time the butter must be frequently stirred, say once in five or ten minutes, so that the whole mass may be thoroughly intermixed, and the top and bottom change places from time to time. When the melted mass boils, the fire is to be so regulated as to keep the butter at a gentle boil for about two hours more, the stirring being still continued, but not necessarily so frequently as before. The vessel is then to be removed from the fire, and set aside to cool and settle, still gradually; this process of cooling being supposed also to require about two hours. The melted mass is then, while still quite liquid, to be carefully poured into the crock or jar in which it is to be kept. In the process of cooling there is deposited a whitish cheesy sediment proportioned to the quantity of butter, which is to be carefully prevented from intermixture with the preserved butter." This is taken from Dr. Forbes' *Physician's Holiday* (Murray): he states further that some add a little salt in the boiling.

Lastly, when butter becomes rancid, it seems, from the experience of a Belgian agriculturist, quoted in the *Agricultural Gazette*, to be possible to remove the bad smell

and disagreeable taste by beating or mixing it in fresh water with chloride of lime. The operation consists in beating the butter in a sufficient quantity of water, in which put "25 or 30 drops of chloride of lime" to 2 lbs. of butter. After having mixed it till all its parts are in contact with the water, it may be left in it for an hour or two, and afterwards withdrawn, and washed anew in fresh water. Another correspondent recommends that the butter should be kneaded with fresh milk, and then with pure water. He states that, by this treatment, the butter is rendered fresh and pure in flavour as when recently made. He ascribes this result to the fact that butyric acid, to which the rancid odour and taste are owing, is readily soluble in fresh milk, and is thus removed.

Churning.—(1.) In those cases where whole milk is churned for butter, the churn is a fixture. It is an upright somewhat conical vessel, made so, however, only in order to secure the tightness of its hooping, and it is of various dimensions, from three feet and upwards in height, and from fifteen inches in diameter, according to the quantity of milk to be treated. This milk is churned when about three days old, varying according to the weather, being first allowed to cool and then placed in large wooden vats to become sour. The practice is to place it in coolers, as in ordinary dairies, until it has acquired the temperature of the air, thereafter to pour it into large wooden vats capable of holding two meals at a time, where it sours; and if churning is done twice or three times a week, to put into the churn all the milk which has become sour, whether it be sixty, forty-eight, or only twenty-four hours old;

never, however, putting sweet milk into the churn along with the sour, as if milk becomes sour by churning, or otherwise than in the natural way, the buttermilk soon becomes rancid and unsaleable, whereas the butter-milk from milk soured naturally retains an agreeable and saleable quality for a much longer time. The milk in summer is churned at the natural temperature; in winter hot water is poured in with it till it is raised to 65° or 70°. In winter, too, when cows are fed on turnips, the milk is poured at once into the churn and allowed to sour there; and, being hindered as much as possible from cooling, and afterwards heated by the addition of hot water, or by the insertion for a time of a tin vessel full of hot water, the butter does not retain the taste of the turnip. The churning commences and is carried on for three hours, a regular stroke of the plunging float-board being an essential part of the process, and a rate of forty to forty-five strokes per minute being maintained. This regularity is attained by the use of steam or water power, it being in the case of the larger churns too laborious for manual labour. The after-management of the butter, when it has "come," is the same whatever method of churning is adopted.

Whatever churn is adopted, it is washed out first with scalding water, and then with cold water before using it. The cream in winter is raised to a temperature of 55° to 60° by the addition of hot water; or, as in some churns is possible, by standing the whole apparatus in a tub containing water of that temperature. A common plan is to let cold water stand in the churn for an hour before using it in summer, and to let hot water stand in it for some time in like manner in winter.

Churns of very many kinds are made. The upright churn has been already named.—The barrel churn, in which the cream fills one half or more of a horizontal cask slung in a framework, provided with shelves projecting from the inside half-way towards the axis, and the whole turned slowly with the handle.—The box churn, in which the vessel holding the cream is stationary, and the churn is agitated by a revolving series of beaters arranged around a horizontal axis, is very common.

Implements for a Butter Dairy.—They must be provided in quantity sufficient for the largest daily yield of milk throughout the year. Twenty-five cows may be supposed likely, during the height of the season, to yield 100 gallons a day, and when milk is left only 24 hours to set up cream, this will need 50 square feet of surface, 4 inches deep, or as this is rather deep, say 60 square feet of surface of cistern, or more, if vessels with sloping edges be used in which to place it for cream: nearly 3, therefore, of the ordinary vessels would be needed for every cow. Now, 100 gallons would, in the course of 24 hours, throw up 10 gallons of cream, and if the churning is done twice a week, a 30-gallon churn, working 15 gallons at a time, and used twice on churning days will suffice; 5 or 6 cream crocks of earthenware, or vessels of tin, capable of holding 4 gallons a-piece, will be needed to hold the cream. A flat butter tub in which to make the butter, and scales and butter prints, will be needed for making it up, and clean maple butter boards, if there be no marble slab, for placing it on in the cool dairy until it is sold. Besides this, of course pails for taking the milk, 3 will suffice for 25 cows, and a sieve through which to pour it into the pans, will be needed. For a small dairy,

as of two cows, much smaller provision is required. A single pail, a hair sieve, half a dozen glass milk vessels, two earthenware cream crocks, each capable of holding a couple of gallons of cream, an American box churn, or one of any other make, capable of churning 3 gallons at a time, a butter tub, prints, butter scales, &c., are all that is needed.

The various appliances now in use in large butter dairies include many implements and machines unthought of a few years ago. A refrigerator (Lawrence's) presents double vertical corrugated surfaces, over which the milk trickles from above, and is collected below, being made cool by cold water passing upwards between them and escaping at top. The immediate cooling of the milk is necessary when it is despatched by railway for consumption at a distance; and it is desirable at all times and in every case. Fixed barrel churns, vertical or horizontal, with axles carrying flappers; barrel churns revolving on horizontal bearings, carrying flanges from the circumference inwards, which lift and dash the contents as the whole revolves; revolving barrel churns, cylindrical or hexagonal, the axis of motion being arranged somewhat diagonally, which gives an additional emphasis and complicity to the dash of the contents as they revolve, and has the advantage of a special position of rest, which enables the drawing off of the contents without risk—end-over-end churns in which the axles or bearings are placed transversely to the length of the barrel, whose contents are flung from end to end as the whole revolves—horizontal oscillating churns, in which the cream is thrown first to one end and then the other of a suspended cradle with somewhat less violence than in the other case:—All these are so many methods by which the cream is made to yield up its butter; and it is understood

now that no torture or violent rapidity of movement is required for this purpose—that the texture of the butter ultimately is rather injured than otherwise by what may be called a destructive violence or rapidity of movement. The butter being removed, as already said, is dealt with by a worker, which in all its many forms is essentially just a deeply corrugated cylinder made to press and roll over the butter on the table, where it is submitted to this kneading.

The machine which has produced and will produce the greatest change of practice in our butter dairies is the centrifugal cream separator. Of this, too, several forms exist, all of them acting by a substitution for the force of gravity in separating the cream, which is the lighter portion of the contents of the milk, the action of a centrifugal force which can, of course, be raised beyond that of gravity to any extent by increasing the velocity of revolution. The whole milk as brought from the cow pours continuously into an enclosed flattish cylindrical vessel, capable of holding 2 or 3 gallons. This revolves from 3,000 to 6,000 times a minute, and the water of the milk carrying curd and sugar in solution, flies to the outer rim of the revolving mass, the cream collecting in the centre; and each, as the whole milk continues to pour in, passes into the tube properly placed to receive it, and is delivered at its separate exit: a rich thick cream pouring from one, and the poorest skim-milk—veritable "sky-blue"—pouring from the other. Skim-milk may thus be had "fresh from the cow;" and it will no doubt command the value which really belongs to it as food, now that it can be had unspoiled, as hitherto it has been, by the knowledge that it is 36 or 48 hours old, and is on the eve of becoming sour.

CHAPTER VI.

CHEESE.

Composition—Curd—Various Cheeses : Gloucester, Cheshire, Dunlop, Cheddar, Derbyshire, Lancashire, Stilton—Utensils of the Cheese Dairy.

The Composition of Cheese depends, of course, upon the mode of its manufacture. The following analyses of actual specimens by the late Professor Johnston may still be accepted as trustworthy; and they probably still represent average quantities of the several cheeses named :—

Ingredients per cent.	Skim Milk Cheese.	Double Glou-cester.	Cheddar.	North Wilts.		Dunlop.
				1st Spe-cimen.	2nd Spe-cimen.	
Water . .	43·82	35·81	36·04	35·58	44·80	38·46
Casein . .	45·04	37·96	28·98	25·00	28·16	25·87
Butter . .	5·98	21·97	30·40	30·11	23·04	31·86
Saline matter.	5·18	4·25	4·58	6·29	3·99	8·81
	100·02	99·99	100·00	99·98	99·99	100·00

The quantity of butter present, to which the richness of the cheese is due, depends, first, on the quality of the milk, next, on its cream being all retained when it is set for curd; and, lastly, on the process of manufacture being conducted so carefully, that the curd shall retain its butter, none of it being allowed to escape with the whey.

The Formation of the Curd is effected by any agent which will set the casein of the milk free from the solvent by which in fresh milk it is held in solution. And the subsequent treatment, which it receives in the processes of cheese-making, has for its object simply the separation of this water, together with the addition throughout it of such a quantity of salt as may check any tendency of the curd to decay. The artificial ferment used is called rennet. A calf's stomach, called a "vell," either with or without its content of curdled milk, is salted and packed away for months, with others, in a jar. Water which has stood upon it, after this, is rennet; and a certain portion, varying according to the exact recipe of its preparation, from half a pint upwards, is added to, say, 100 gallons of the milk to be "set."

Notwithstanding that a general definition of the process may be given in these terms, yet upon the niceties of the various recipes adopted in the preparation and use of this rennet depends much of the varying quality of the cheese produced by it. In practice, these prepared "vells" are purchaseable of the grocers in all cheese-making districts, who keep them in a salt pickle. They are purchased a year old or more, in winter, at the rate of about two for every cow, that quantity being used according to Gloucestershire practice in the preparation of the rennet needed by the milk which each cow will yield. These vells, according to one method, being delivered in a wet state, are placed in a saturated brine, 6 to every 2 gallons, and a 30 to 40-gallon cask (old olive jars are very suitable) is prepared at once. The liquid is ready for use in about 2 months, and it improves with age, unless diluted by the addition of more brine, in which case fresh vells must

be added to it. In other cases a piece of a dry vell is soaked overnight in half-a-pint of water, and this is the rennet used on the morrow. Latterly a prepared essence is being used in preference to home-made rennet, with, it is said, more uniformity of result; for on the quality of the rennet as well as on other things the resultant cheese depends. Vells vary considerably in size. Irish vells weigh from 6 to 8 ounces each, and the numbers specified are to be taken as applying to those of average weight. For details of their use we must refer to the detailed account, given in the following paragraphs, of the several methods of cheese-making.

The Accommodation needed for Cheese-making varies in different districts. Everywhere, however, the same instructions as to cleanliness are of course imperative. In Gloucestershire a room on the north side of the farmhouse serves for holding the milk, whether set in pans on shelves for cream, or in the cheese-tub on the floor for curd. Here too are the leaden cisterns in which the whey stands, a foot deep, for cream, and from which, after skimming, it drains away to the pig's vault. On the north side of this room is a paved shed, in which churning is done, and in which vessels are placed to dry; and at one end of this shed is a wash-house (with the well close by), with furnace and boiler, in which milk may be warmed, and where the vessels are washed. In addition to this, there is a cheese-room, generally a loft over the dairy; but for hot summer weather a detached and cool airy place is to be preferred. Here on the wooden floor and on wooden shelves the cheese are placed almost close together and turned repeatedly, until ripe for sale.

Gloucester Cheese-making.—Under ordinary management, the Gloucester cheese is made twice a day. The morning's milk is heated or cooled to about 80° in one or more large vessels of from 80 to 100 gallons: a pint and a half or thereabouts of rennet is added to every 100 gallons: in an hour's time or so, when the curd has set, the curd-breaker, a wire sieve, fixed on the end of a pole, is slowly and repeatedly drawn hither and thither through the mass, the whey is baled out, the curd is pressed by the hand, crumbled fine, and placed in a cloth and in the cheese vat under a press for 12 hours; it is then salted and turned, and again put under the press. It is kept there as long as there is press-room for it, and afterwards transferred to the dairy shelves, where it is turned at intervals, and where it gradually ripens. The whey baled out of the curd-tub stands and throws up a cream, from which an inferior butter is made. The less the quantity of cream that rises, the more of course is the butter left in the cheese; and the more gentle the management of the curd and the removal of the whey, the less is the quantity of this cream that rises on it.

Keevil's patent curd machine, now largely used in the county, consists of a cylindrical tin vessel, which is used as a cheese-tub, with a drainer up the side from top to bottom, through which the whey escapes, and with a revolving frame of vertical and horizontal wires, by which the curd is systematically broken.

It needs, after the curd has set, that a few cuts through it with a knife be made, else this revolving framework of wires will carry the whole mass of curd with it, which will thus escape without being cut; after this, the revolving wire cutter is pushed round with extreme slowness; and

gradually the mass of curd is thus systematically reduced to little fragments, and sinks, and the clear green whey is drawn off through the strainer. It has been separated so gradually, that it throws up little or no cream on standing, and therefore it at once goes to the pig's vault. Keevil's machine is a fixture on the dairy floor; it is connected with an outside hopper, through which the milkmen pour the contents of their pails, and thus they never enter the dairy. It may be a jacketed vessel, and thus receive hot or cold water around it for the regulation of the temperature of its contents. This or other similar machines has long been adopted in Gloucestershire, with, we understand, satisfaction to those who have broken through the ordinary practice of the district by employing it.

Cheshire Cheese-making requires the use of a milk-house, where the evening's milk is placed to cool, a dairy where the cheese-tub stands, into which the morning's milk is at once poured, and where there is a furnace and boilers for scalding the whey and for boiling water; where also the cheese presses stand and (if there be no drying house) whence the cheeses, after pressure, are finally removed to the cheese-room or store. The cheeses vary in size from ½ cwt. upwards.

Cheese is made only once a day, and in small dairies sometimes once only in two days; a cool place in which to keep the milk is therefore indispensable. The rennet used in Cheshire dairies is made fresh from the vells each day. Two bits of 2 or 3 square inches are cut off them, and put into half a pint of warm water the day before use, along with a tea-spoonful of salt, and this effusion is the rennet, and suffices for 50 or 60 gallons of milk. The

following may be taken as the ordinary history of a Cheshire cheese:—The cows are milked at night, and the milk poured through a sieve into tin pans on the floor of the milkhouse. This milk is skimmed in the morning, and then poured into the large tub where the curd is "set." As the morning's milking proceeds, the pailsful are brought one after another and poured through the sieve into this tub. A pan of milk, containing more or less, according to the quantity whose temperature is to be raised sufficiently high by the addition of it, is warmed by floating in a boiler in the dairy; and, when sufficiently hot, the whole of the cream just taken is mixed with it, and the whole thus warmed is poured at last into the tub, which thus contains the whole milk, cream and all, of both "meals." The temperature of the milk when well mixed should be about 75° Fahr. The liquid colouring matter, "annatto," about half a gill, dissolved in half a pint of warm water, is added to the 100 or 120 gallons which may be then in the tub as the produce of 40 cows—a half-handful of saltpetre may be thrown in with a view of correcting the bitterness which is to be detected while the butter-cups are in full leaf; and the rennet, about a pint of brine, in which two or three little bits of the prepared calves' vells have been steeped over night, is added to the milk, which is then left for an hour covered up till the curd has fully formed. It is then cut slowly with a wire curd-breaker, and the curd sinking, the whey is baled out; the curd is collected and squeezed both by hand and the direct pressure of a weight above a board placed upon it, and the last of the whey being removed, it is lifted either into a basket or into one of the large Cheshire cheese vats ("thrusting tubs"), pierced with holes for the further escape of fluid—the lower part being a wooden

cylindrical vat, and the upper a tinned cylinder slipping into it as the curd on pressure sinks. After a certain pressure in this *form*, the curd is removed and cut and broken by hand or by a curd mill, and from 1 to 2 lbs. of fine salt is scattered over it, according to the weight of the cheese; about 1 lb. to every 40 lbs. of cheese is a common quantity. The whole curd being then rebroken, is refilled into the vat, into which a cheese cloth has previously been placed. It is then put gradually under pressure, which after the second or third day amounts to many hundredweights upon each cheese.

Every day the cheese is turned and wrapped in fresh cloths; and on the seventh or eighth day of this treatment, or as soon as dry, it is removed to the loft and there swathed around with strong girthing, and placed on a bench. By and by it is laid, still swathed as before, on a layer of straw on the floor of the room, and there it lies till from ten weeks to four months old, when it is ready for sale.

In some dairies, in order to the perfect extraction of the whey, skewers are used on the first day to pierce it, being thrust repeatedly into it through the holes in the cheese vat, in order to the formation of drains for the liquid. The whey is heated in a boiler; some drainings from the cheese of the previous day, commonly called "thrustings," are added to it; and after a first skimming some sour buttermilk is thrown into the boiler, and then the heat raised to 180° Fahr., when it iss kimmed again. By the first skimming a cream called "fleetings" is obtained, yielding a very good butter; and by the second, a substance used principally for feeding calves; the whey is afterwards given to the pigs. Excepting a portion of the cream used in the

house, and that which thus comes from the whey, the Cheshire cheese is a whole-milk cheese, and as rich, therefore, as any that is made.

The use of colouring matter does not in any way improve the cheese, nor add to its value, and in many dairies it is altogether discontinued.

The Dunlop Cheese-making differs from the Cheshire in the use of stale rennet, as in Gloucestershire; in the greater heat, 85° or 90° Fahr., of the milk when the rennet is added—a tablespoonful to every 20 gallons—and in the consequent extreme rapidity of the setting of the curd, which is ready for cutting in a quarter of an hour. The curd is put up in cheeses of 28 to 36 lbs. weight; they are whole-milk cheeses, made night and morning in dairies of sufficient size; and where enough milk is not provided at one meal, then, as in Cheshire, the evening's milk, after being skimmed, is heated to the requisite temperature, and with the cream is added to the morning's meal; and the whole is set for curd at the temperature stated. Dunlop cheeses are of a fat and mild tasted character. Their management after the setting of the curd is very much the same as that of Cheshire.

Cheddar Cheese-making differs from that already described, chiefly in the scalding of the curd; which is done by heating a portion of the whey, and letting the curd remain in it for a considerable time at a temperature even above the natural heat of the milk. The following is a description of the dairy management of the late Mr. Harding, at Compton Dando, Somersetshire. The milk is poured from the pails through a sieve into a receiver outside, from which

a pipe conveys it through the wall to the cheese-tub or to the coolers. A canvas bag is also placed over the inside end of the pipe, so that a double precaution is used against impurities entering with the milk.

The rennet is prepared by steeping perhaps five vells at once, and this usually suffices for two weeks, in which time about 21 cwt. of cheese may be made.

Immediately after the morning milking, the evening and morning milk are put together into the tub. The temperature of the whole is brought to 80° by heating a small quantity of the evening milk. After the rennet is added, an hour is requisite for coagulation. At eight o'clock the curd is partially broken, and allowed to subside a few minutes, in order that a small quantity of whey may be drawn off to be heated. This whey is put into a tin vessel and placed in a boiler in an adjoining apartment, to be heated in hot water. The curd is most carefully and minutely broken, and then as much of the heated whey is mixed with it as suffices to raise it to 80°, the temperature at which the rennet was added. Nothing more is done to it for another hour.

A little after 9 o'clock a few pailfuls of whey are drawn off and heated to a higher temperature than at 8 o'clock. The curd is then broken as minutely as before, and after this is carefully done, an assistant pours several pailfuls of the heated whey into the mass. During the pouring in of the whey the stirring with the breakers is actively continued, in order to mix the whole regularly, and not to allow any portion of the curd to become overheated. The temperature at this time is raised to 100°, as ascertained by the thermometer, and the stirring is continued a considerable time, until the minutely broken pieces of curd

acquire a certain degree of consistency. The curd is then left half an hour to subside.

At the expiry of the half hour the curd has settled to the bottom of the tub. Drawing off the whey is the next operation. The greater proportion is lifted in a large tin bowl, and poured through a hair sieve into the adjoining coolers. As it runs into the leads it appears to be very pure. When the whey above the mass of curd is thus removed, a spigot is turned at the bottom of the tub, and the remainder is allowed to drain off, which it does very rapidly without any pressure being required. To facilitate this part of the work the tub is made with a convex bottom, and the curd is cut from the sides of the tub and placed on the elevated centre. It is carefully heaped up, and then left for an hour with no other pressure than its own weight. After this interval it is cut across in large slices, turned over once on the centre of the tub, and left in a heap as before for half an hour. The whey drips away towards the side of the tub, and runs off at the spigot; and no pressure being applied, it continues to come away comparatively pure. After undergoing these easy manipulations, and lying untouched during the intervals that have been mentioned, the curd is ripe for the application of pressure. But great care is taken not to put it into the vat to be pressed at too high a temperature. If the heat be above 60°—and it usually is higher at this time—the curd is broken a little by the hand and thrown upon a lead cooler until it is brought down to the desired temperature.

The after-management of the cheese resembles that of Cheshire. A little salt, 1½ lbs. per cwt. or thereabouts, is added to the crumbled curd, and it is mingled and broken by the curd mill. The cheese vats are placed under the

machine, and are piled one above the other as the curd falls down. A cloth is put over each vat when the breaking is over, the curd is reversed in the cloth, put back into the vat, covered up, and placed in the press for about three quarters of an hour. After this, the cheese is taken out, and a cloth wrung out of warm water is put on it. It is again changed at two and at six o'clock, after which dry cloths are put on it. Care is taken that the cheese fills the vat properly. To accomplish this, the vats, at making up, are filled rather full, and the edges of the cheese are pared in the afternoon. Next morning the cheese is rubbed on both sides with salt, and the same cloth is put on again. On the third morning it is treated in a similar manner. The cheese is put into the vat without a cloth on the fourth morning, and a little salt is rubbed over it to keep it from adhering to the wood. After the fourth morning, it is reversed in the vat, without a cloth, each morning, until the process is complete about the sixth or seventh morning.

Keevil's or other similar apparatus is now generally used, by which a jacketed cheese tub of tin may be surrounded by a stream of hot water; and so the milk and whey retained at any temperature that is required, without the necessity of removing large quantities of milk or whey to a boiler every time of cheese-making for the purpose of being heated.

Derbyshire Cheese-making does not differ materially from that which obtains in Gloucestershire in making a thick (double Gloucester) cheese. It is usual to make but once a day, unless in very hot weather, when it may be doubtful if the milk can be got cool and kept sweet during the night, in which case cheese is made in the evening as

well as morning. In general, however, the evening's milk is put in thin layers in the cheese-tub and other vessels to cool during the night, tin vessels of cold water being put to stand it in in order to subject it to as large a cooling surface as possible. In the morning, if much cream has risen, it is partly skimmed, and, if necessary, warmed up with some milk and added to the morning's milk, so as to bring the whole to about 80°. In the summer time, however, the rennet has often to be added when the milk is naturally warmer than this. Enough fresh-made rennet is added to set the whole in an hour or less. After the curd has been broken with the common sieve curd-braker, used gently for a sufficient time, a presser is used—a sort of heavy metallic sieve "follower," which sinks gradually through the whey and ultimately lies upon the curd, enabling the baling out of the whey. After this has been for the most part taken out, this follower is forced hard down on the curd so as to squeeze and still further separate the whey from it. The curd may then be slightly salted, though this is not always done at that time. It is broken by hand into a vat and pressed; taken out and broken up again, re-vatted and again pressed; and this may be done more than once—as often, indeed, as seems to be required. It is at length finally vatted, in sizes of about 4 to the cwt.; its whole surface is made to take in as much salt as it will hold by rubbing and pressing; this gets liquified by the exuding moisture and is absorbed. It is dry-clothed and changed in the press daily, and is in the press four or five days before being finally removed to the cheese-room, where it is turned at gradually-increasing intervals until ready for the market.

In some districts, and notably in Lancashire, no salt is

put in the curd, but the cheeses, after two or three days' pressing, are placed in brine for a week, in which they float, going in soft at first and coming out hardened. They are taken thence to the cheese-room, and turned daily till sold.

Stilton Cheese is made chiefly in Leicestershire, from the whole milk of the morning to which more or less (often none) of the cream of the evening's meal has been added. The following is a recipe :—

The utensils required in its manufacture are the same as those in ordinary use, excepting the cheese-vat, which in this case is a tin-plate cylinder, 10 inches high, and 25 inches round it, without top or bottom, having the sides pierced with holes to let out the whey. The rennet is made in the same way as usual. About 9 gallons of new milk, and, if to be very rich, the cream off 2 or 3 gallons of milk (the cream to be warmed before being put to the milk), are used in the manufacture of one cheese. If sufficient new milk cannot be obtained, the night's milk and cream are to be used with the morning's milk, as well as the extra cream. The rennet is to be put in when it is of the natural temperature of new milk. When it has become curd, it is not broken as in Gloucestershire and elsewhere, but a canvas strainer is laid in a cheese-basket, and the curd put into it, breaking it as little as possible; the cross corners are drawn together, and it remains in this way some hours, until sufficiently firm to slice. It is laid in the vat in slices, a layer of curd and a sprinkling of salt alternately; this is continued until the vat is full, then a flat square piece of board is placed at the top of the vat, one having been previously laid at the bottom; and placing one hand at the top, and the other underneath, the cheese

is to be turned over very quickly: its own weight is a sufficient pressure. Keep turning it every two or three hours, and two or three times the next day. It is to be kept in the vat three or four days, according to the firmness of it. When taken out, a thin piece of calico is to be dipped in boiling water, and wrung out, and then to be pinned tightly round the cheese. This cloth remains on it until it is thoroughly dry. The cheese should be turned twice a day: it does not require any more salt than that which is put in with the curd. There is a great deal of trouble with this kind of cheese; from the constant dampness of the skin it is apt to get fly-blown—maggots are the result—and the cheese is destroyed.

Of other English makes we merely refer to Bath, truckle, and sage cheese.

Truckle Cheese.—Truckle cheeses are made in vats from 6 to 9 inches deep, and about 9 inches across. When the vat is about half full a small tablespoonful of fine salt should be put into the middle of the cheese, and well rubbed into the curd, taking care that it does not spread to the outside, which would cause it to separate, and be of injury to the cheese. In making truckle cheeses the curd should be quite sweet, thoroughly crumbled, and made as dry as possible before filling the vats, and it should be pressed very firmly in with the hands, and allowed to remain in the press four or five days—turning them every day, and salting them three times. Truckle cheeses are better for being kept 12 months. They are in some dairies made throughout the whole season. There is, however, a risk, under ordinary management, of their bulging and heaving during the extreme heat of the summer owing to fermentation; and this

difficulty does therefore in most dairies confine the making of this sort of cheese to the autumn months, when less heat interferes with the ripening of it.

Sage Cheese should be kept twelve months before it is fit for use. Bruise a quantity of sage in a mortar, also a little spinach for the sake of the juice, which will give a green colour, the sage alone not being bright enough in itself; these juices, squeezed together through a cloth and added to about a pailful of milk with a proper proportion of rennet, will make enough sage curd for one thick cheese. When the whey is drawn from this in the usual manner, the curd will be found of a much deeper colour than might be expected from the pale green given to the milk. This sage curd should be kept quite separate from the bulk. When ready for the vats, having been crumbled into small particles separately, some of the green curd should be mixed with the other (about one-third is sufficient), either by laying it in rows or mixing it together in the vat; care should be taken that none of the whey drawn from it gets into that intended for butter, or it will give it the flavour of the sage. The after-management of this cheese is the same as that of other thick cheeses.

Bath Cheese.—Take one gallon of new milk, and add three quarts of cold water, with about two or three tablespoonsful of rennet, and when turned into tender curd take it out gently with the skimming dish, and lay it on a sieve, but do not break it; the whey will thus drain sufficiently from it before placing it on a cloth in a small square vat made for the purpose, about an inch and a half thick, and about 9 or 10 wide. The above quantity of curd will be, as

nearly as can be ascertained, enough for one cheese; it requires to have one or two dry cloths applied to it, and in two days it may be taken out of the vat and placed between two pewter plates and turned every day, the plates being wiped dry. It will generally be fit for use in a week or nine days.

Utensils for the Cheese Dairy.—Besides the ordinary milking-pails, and sieve through which the milk is poured from them, a deep cheese-tub, to stand on the floor of the dairy, in which the curd is set, is required, holding 4 gallons, or thereabouts, for every cow in the dairy. It costs 7*d.* to 9*d.* per gallon. A "ladder" is needed to rest across this tub for carrying the sieve through which the milk is poured. Curd-breakers, double or triple knives, and an open wire-work sieve, to be thrust to and fro, are required. A curd-mill, costing from 20*s.* upwards, being simply a hopper, at the bottom of which is a cylinder studded with short radial arms revolving between corresponding pins fixed in the sides of the trough, and passing the curd placed in the hopper in a crumbled state, is also needed. Keevil's curd-breaking and cheese-making apparatus is, as we have said, largely used. Vats or leads of sufficient capacity to hold the whey, where it is set for cream, are also needed. Cheese-vats, in which the curd is pressed into the form of the future cheese; and cheese-presses, either direct masses of stone lifted by winch and rope and pulley, or lever presses, are needed. The heaviest of the former consists of a block of stone, of nearly 3 feet cube, and weighing 20 to 30 cwt. The latter are of various forms, and produce, by the action of a small weight, whatever pressure is desired. They cost about 50*s.*; or,

if two together in one frame, about 5*l.*, and may be used to exert a pressure varying from 1 cwt. up to 30 cwt., or even more. We may also name here, as a recent invention with probably a future, a series of cheese-shelves arranged in a book-case form, *i. e.*, closed on one side, and slung on two pivots, enabling it to be swung round, bottom upwards, so that the top of each shelf containing cheese becomes, in its turn, the floor on which those cheeses rest; and the whole work of turning a number of cheeses is done at once.

Insects affecting Cheese.—Cheeses are liable to the attacks of various insects, the principal of which are the cheese-mite and the cheese-fly, *Piophila casei*, whose maggots are the well-known jumper. The cheese-fly, we may add, is a little greenish-black fly, with yellowish head and legs. In order to escape its attacks, the cheeses should be pressed dry, and so made as not to crack; they should also be repeatedly wiped with a flannel cloth, and turned on boards kept clean by scrubbing and occasional rubbing with fresh oil.

CHAPTER VII.

GENERAL MANAGEMENT.

Dairying and Grazing—Profitable Use of Milk—Cropping of a Dairy Farm.

Dairying or Grazing.—A tenant of grass land has the choice of many modes of turning it to account. If it be very rich grazing ground, he may devote it wholly to the feeding of beef: if very poor grass land with some arable attached, he may devote it wholly to the rearing of young stock, bringing up five to ten calves to every cow he keeps. Under more ordinary circumstances he may keep either a butter dairy or a cheese dairy; or it may be his interest to use the milk in fattening veal. The nature of the market for his produce will probably determine his choice. It is no part of our plan to discuss the relative merits of grazing and dairying here, but there is one point of the comparison which ought to be alluded to, and that is the immense draught made upon the resources of the land by any system which involves the annual sale of the milk, either whole or manufactured, as the sole produce of the land.

Milk contains a good deal of those parts of the earth of soils on which their fertility very much depends. As the sole food of the young, it feeds their bones as well as their flesh, and in its mineral part, therefore, is to be found the mineral part of bones, as well as the alkaline and other

mineral substances held in solution in the juices of the living animal. 1000 parts of milk contain from 5 to 7 parts of ash or mineral matter; and this consists about one half of phosphate of lime (bone-earth), and the rest of soda and alkaline salts. The following is a detailed analysis of two samples.

Ingredients of 1000 lbs. of milk:—

	1.	2.
Phosphate of lime	2·31 lbs.	3·44 lbs.
,, magnesia	0·42 ,,	0·62 ,,
,, iron	0·07 ,,	0·07 ,,
Chloride of potassium	1·44 ,,	1·83 ,,
,, sodium	0·24 ,,	0·34 ,,
Free soda	0·42 ,,	0·45 ,,
	4·90 ,,	6·77 ,,

If a cow yields 600 gallons of milk a year, then, whether this be sold away altogether, or converted into cheese for sale, or set for cream and made into butter and skim-milk cheese, or given to young stock to be afterwards sold, these products being sold off the farm, it loses in this way from 30 to 40 lbs. of mineral matter from its soil.

This is no doubt a small quantity; but continued for a long series of years it undoubtedly tells upon the fertility of the soil, and is a loss to which rich grazing grounds, where full grown animals are brought simply to be fattened, are not subject. In illustration of the perpetual drain of phosphates which the cheese manufacture entails upon the soil, it may be mentioned here that the dairy pastures of Cheshire have been wonderfully improved by the addition of bone dust as a top-dressing to the land, a manure which supplies just those ingredients of which the cheese had deprived it.

The most profitable use of Milk.—This necessarily depends altogether on the market. (1.) To sell the whole milk direct to the consumer is probably the most profitable method. One penny a pint is a common wholesale price to the cow keeper. His cows may yield under varying treatment from 600 to 1000 gallons annually, and thus return from 20*l.* to 33*l.* annually a-piece. (2.) To make milk into butter and skim-milk cheese, may, at the yield of 600 gallons annually, and calculating 22 pints per lb. of butter and 1½ gallon per lb. of skim milk cheese, yield as follows :—

	£	*s.*
600 gallons of milk = 60 gallons of cream = 210 lbs. of butter, at 1*s.* 4*d.*	14	0
540 gallons of skim-milk = 360 lbs. of cheese, at 4*d.* per lb.	6	0
Total annual yield per cow	£20	0

(3.) To make milk wholly into cheese may, with a yield of 600 gallons of milk, result in 5 cwts. of cheese per annum; a very unusual produce, however; and this at 64*s.* per cwt., a moderate price, results in an annual produce of £16 per cow, to which must be added, perhaps, 50*s.* worth of butter and bacon, or £18 10*s.* in all. The more common produce, however, is :—

	£	*s.*	
4 cwts. at 64*s.*	12	6	
Together with the extras	2	10	
Or, in all	£15	6	per cow.

(4.) To use the milk wholly for fatting veal, at the rate of 10, 16, 20, 24, 27, 30, and 32 gallons in seven successive weeks, using 160 gallons or thereabouts in that time for producing about 1 cwt. of veal, will enable each cow thus

to fatten 4 cwts. or more of veal per annum ; and this at the price of 4*l.* per cwt. would yield 16*l.* annually per cow. From this, however, must be deducted the cost of whatever other food the calves consume, and also a certain sum at which the risk attending the management of young stock must be valued—a risk which does not accompany the other modes of turning milk into money.

It may thus be assumed, after making sundry deductions, that 24*l.*, 20*l.*, 18*l.*, and perhaps 16*l.* may be taken as the produce of well-managed cows, in milk, butter, cheese, and veal respectively; the value of the calf, 30*s.* or 35*s.*, when a week or ten days old, has to be added. It will, however, be generally felt that, excepting, perhaps, the first of these cases, these figures stand too high for ordinary experience; and certainly that which is true of well-managed individual cows is not necessarily true of a whole herd, however perfect the management may be. In illustration of this, two facts may be mentioned, one of which entirely corroborates our estimate; but the other, the more trustworthy of the two, considerably discounts it.—1. The dairy statistics of 15 farms in Gloucestershire already referred to (pp. 10, 12, 16), prove that in the year of their collection 439 cows produced 1604 cwts. of cheese; 5268 lbs. of milk-butter, 11,420 lbs. of whey-butter, besides a sale of 354 calves and of 1756 score lbs. of bacon. The total sales at present prices would stand thus :—

	£	*s.*	*d.*
1,604 cwts. of cheese, at £3 4*s.*	4,844	16	0
5,268 lbs. of butter, at 1*s.* 4*d.*	351	4	0
11,420 lbs. of whey butter, at 1*s.*	571	0	0
354 calves, at £1 5*s.*	442	10	0
1,756 scores of bacon, at 10*s.*	878	0	0
439 cows produced	£7,087	10	0

This was equal to 16*l.* 8*s.* per cow, corresponding very nearly to the figures given as true of the money produce of cheese-making.—2. The other fact is that in many large dairy districts it is common for the farmers to let their cows for the year to a dairyman, agreeing to set apart certain pastures for them, and to give them certain quantities of fodder, and of green and other food. The hirer of the cows has the use of all the accommodation which the farmery affords, the use of dairy utensils, &c., and he undertakes the entire management of the animals, and of their produce, which belongs to him while they remain in his hands. And the fact to which we allude is, that the farmer is willing to let his cows to the "bower," as he is called in Wigtonshire, for from 10*l.* to 12*l.* apiece: which, if their average produce realises 14*l.* or 15*l.*, seems to leave a small enough margin for the labour and the profit of the dairyman who hires them.

The Cropping of a Dairy Farm has already been considered (see page 23). We refer to it again under this section to insist on the great advantage to large dairy farms of a considerable portion of the land being arable. The ability to maintain cows during the winter season—when dry or not yielding milk enough for the maintenance of the general dairy management—on roots and straw, instead of hay, and thus to set apart a larger portion of the grass for summer pasture to its own great advantage, and to the greater productiveness of the cows at their most productive period, cannot be overrated. If every 100 acres of grass land, being at the rate of more than 1½ acres per cow of whole summer pasture, together with the aftermath of a corresponding quantity needed for winter hay, will

maintain a herd of 30 dairy cows, then any source of winter feeding which will displace two-thirds of the hay required will set free for pasturage two-thirds of the extent of grass-land to be mown. It is not too much to say that by 30 acres under arable culture as much winter food will be provided as by 50 acres of grass-land mown. Supposing, then, these 100 acres to be divided into 80 acres pasture and 20 acres arable, it is plain that of the half of this pasture (40 acres), which ordinarily would fall to be mown, at least two-thirds (26 acres), would be set free by the winter food (straw and green crops) yielded by the 20 acres arable: and the stock capable of being kept on the remaining 80 acres pasture, as compared with that on the 100 acres of whole pasture, depends on the relative summer produce of 66 acres whole grass and 14 acres aftermath, as compared with that of 50 acres whole pasture and 50 acres aftermath. There cannot be a doubt that the former will yield more food than the latter, and at the most productive time of the year, while the land will at the same time, under this plan, be more likely to increase from year to year in value. It thus appears that a larger dairy stock can be kept upon a farm so managed, while, at the same time, one-half of the arable land will be yielding its valuable produce of grain for sale. It seems, however, also to be certain that the use of home-grown grain, bean and pea-meal, oats and corn wheat, is economical and desirable while the prices are so low as they have been in 1884-5.

Let me add as a postscript that the selection and maintenance of the herd—gentle, regular, and punctual treatment of the animals throughout the year; provision of

sufficient wholesome food for them, and abundant water, with frequent change of pasturage when at milk—*these* are the special maxims of successful dairying. If on the one side of these we have the proper cultivation and management of the land, and on the other, cleanly, careful, and skilful management in the dairy, then a maximum of dairy produce may be expected. But this depends essentially on the health, and therefore on the treatment, of the animals which yield it. If one word more be permitted it should contain the answer of an old dairy farmer when asked as to the secret of his success. It had come principally, he said, of seeing for himself that his cows were always thoroughly milked out.

CHAPTER VIII.

FOREIGN DAIRYING.

DENMARK.—FRANCE: French Cheeses, Brie, Coulommiers, Géromé, Journiac, Livarot, Mont d'Or, Neufchâtel, Mignot, Pont l'Evêque, St. Marcellin, St. Remy.—GERMANY: Limburg and Backstein cheeses.—HOLLAND: Edam and Gouda cheese, Delft butter.—ITALY: Gorgonzola, Parmesan, Ricotta cheeses.—SWITZERLAND: Emmenthaler, Gruyère, Vacherin, Schabzieger.

DENMARK.

IT is not necessary to enter fully into the system of dairying in Denmark, as far greater space would be required than the limits of this work permit. It may be remarked, however, that Danish dairying, though but of recent creation, so energetically has it been conducted, has become, if we consider the size of the country, the most prominent of any in Europe. It is true, however, that cheesemaking is here still in its infancy, and that there is practically no cheese which is essentially Danish, made in any considerable quantity.

The butter of Denmark is now so famous in this country, that it not only obtains a higher price than the best British, but it often beats the choicest samples from France; and this the French authorities themselves admit with regret, and so highly do they rate the work of the Danes, that a Danish dairy has recently been travelling to the various French exhibitions. At the present moment, the centrifugal separator is doing immense work in

Denmark, and the system is as follows:—The cows are milked very early in the morning, and the milk is immediately cooled and passed through the separator; but the cream is not churned on the same day. It is, however, placed in vats where a small quantity of sour material is added, in order that it may be sufficiently sour for churning on the following morning, it having been proved beyond doubt that butter made from sour cream not only keeps better, but is produced in larger quantities. The barrel and Holstein churns are in general use, and churning is continued until the butter comes in small grains, when the butter milk is run off, and the butter carefully washed in the churn with very cold water; for upon many of the farms ice is used for the purpose of keeping everything cool. Where the butter-worker is not used, though this, like the separator, is now becoming popular, the butter is worked and made up by hand either upon a small table or in a wooden trough. Here the dairy-maid thoroughly manipulates it, and as each piece is kneaded, it is laid aside and salt strewn upon the top, when the remaining pieces as fast as they are finished are placed upon it and salted in a similar manner. When all the butter has been worked, and the pile is complete, it is cut down in slices, and these are again kneaded with the hand in order to thoroughly amalgamate the salt with the butter. In hot weather ice is used to keep it solid, but it is quickly packed in kegs and sent to the exporter.

A great deal of attention is paid by the Danish Government to the proper instruction of young people destined for agriculture; and the majority of the best dairy farmers who are sufficiently interested are provided with pupils sent by the Professor of Agriculture, or obtained by them-

selves. These remain at the farm from twelve to eighteen months, paying a small fee for the time they are there. They manage and milk the cows, assist on the farm, even to mowing and harvesting, and are taught in the most complete manner the whole routine of dairy work. Each pupil is supplied with a small book in which is a slip for each day, and upon this he enters the returns of his department and endeavours to show a better weekly return than his competitors. These figures are checked by the head dairy-maid, who also keeps a book showing the quantity of milk obtained, and cream and butter yielded, with minor details which are very necessary in a large dairy. Where the cream separator is not used, the Swartz system is generally adopted. This consists of a vat some 9 ft. by 2½ to 3 ft. and some 2 ft. in depth, which is built of concrete or brick lined with cement. At one end is a tap for the supply of water, and at the other an outlet pipe to carry surplus water away. This vat is usually built in the milk room on the coldest side of the house, and is in summer daily provided with ice, which is allowed to float in the water. As the milk is brought in it is strained and poured into the Swartz cans, which are oval in shape, 24 inches deep, by about 8 inches wide, and 16 inches long. The milk remains in these cans from 10 to 12 hours, when the cream has all risen and is skimmed off. The skim milk is then taken away either for manufacture into cheese, or for the house and the cattle, and the next milking is poured in. This system is extremely simple, but cannot be properly conducted at a higher temperature than 45° F. If, therefore, a cold spring of water can be obtained which will not rise higher than this, ice will not be required, but in reality an

exceptionally cool milk room is required in addition to the water. Ice is generally preserved in Denmark, either in barns or square yards, with four brick walls, and if well buried in sawdust and examined weekly so that crevices may be filled up by treading the sawdust in, little difficulty is found in keeping it until the end of the summer, and frequently indeed until a second summer.

In Sweden and Norway the system of butter making is very similar, the best dairies being in the south of Sweden, in which part we have seen the work conducted. There is very little difference between the Danish and Swedish systems, and at the present time it is the aim of both Swedes and Norwegians to carry out the Danish system in its entirety, and to obtain Danish prices. The cream separator is now being largely used in these countries, and almost every improved appliance is being adopted. The Swedish system of setting is found everywhere; but the cattle are by no means so good as those in Denmark. The only cheese worthy of the name which is made in these countries and which is special to them, is the "Myseost," which is made from whey, and largely composed of the sugar of milk, as most people can tell by the peculiar grittiness felt in eating it. Its colour is generally green, and although sweet, its flavour is by no means agreeable, and a taste for it has to be acquired before it can be enjoyed. The whey is boiled upon the fire until almost three parts have evaporated, it being continually stirred the while. During the process the top or cream of the whey which had previously been skimmed off, is added, and when a scum or foam appears upon the surface this process ceases. As may be supposed after so much evaporation of water, the residuum has become a sticky

paste, which, as we saw at Madame Nielsen's, was poured into a kind of mortar and there beaten with a pestle by seven or eight dairy-maids in turn, until it was ready to place in the mould, where it remained for pressure for about two or three days, when it was sold to be eaten fresh. This cheese can be improved by the addition of new milk or cream during the process of heating.

FRANCE.

Although the dairy is part and parcel of the system of agriculture in almost every part of France, it is hardly necessary, perhaps, to say, that it is much more extensive, and far more perfect in its arrangements in the Northern than in the Southern departments, where the culture of the grape is more suitable to the climate, and congenial to the people. It is true that the cultivation of the breed of dairy cattle and the manufacture of the famous cheeses peculiar to France, are conducted in many districts in the centre and west of the country; but perhaps there are none which can approach those of Calvados and La Manche, whether it be in the manufacture of cheese and butter, the system of cropping for dairy purposes, or the production of the highest quality of dairy cattle. This being the case, the general remarks which follow have particular reference to those departments, which may be taken as an example of the highest class of dairy farming in France.

The cows principally preferred are those of the Cotentin race—large fleshy animals of fine quality, and magnificent milkers. These animals, together with the luxuriant pasture of these departments of Normandy, have much to do with the system which has been adopted and raised to

such a pitch of celebrity. While it is the custom to house the cattle in winter, and to feed them upon hay, which is seldom built in ricks, but placed in the barn in small bundles of about 10lbs. each,—with mangolds, turnips, and even carrots, they have a great idea of summer pasturing; and, to such an extent is this conducted, that we have seen herds of cattle turned into meadows with two feet of grass, almost ready for the scythe, and into which the dairy-maids went three times a day for the purpose of milking. This is, indeed, a common custom; and in large dairies, with the aid of the deep brass *cannes*, holding from four to eight gallons, which are carried upon the head of the girl, or placed in panniers, two upon either side of the back of a donkey, the milk is all obtained without the necessity of driving the cattle home. The dairy-maid, like the labourer, is a hard-working and invaluable servant, whom it would be difficult to equal in this country. When the milk is taken to the farm, it is first strained, and then poured into earthenware pans, which somewhat resemble in shape the galvanised iron pail used in this country, being much larger at the top than at the bottom. Sometimes, however, these pans are almost oval in shape, and similar in diameter at the top to the bottom, with a handle on either side, so that the system of setting the milk is quite different from that adopted in England, and is rather a deep than a shallow one. The milk room, too, is entirely different from those common in England. It is generally a plain apartment with a flagged floor, and a drain down the centre. The milk pans are either set upon a small raised stone or brick shelf upon two or three sides, or within a wide gutter, which is formed by brickwork being set about twenty inches from the wall, this being either

partially filled with water, or arranged for water to be continually running through. In some milk rooms, however, there is hardly any system; the milk cans being placed at one end of the apartment in any position on the main floor. As a rule the churning and working of the butter is not conducted in this apartment, which is reserved entirely for milk. There are three systems adopted in raising the cream. Sometimes it is skimmed from entirely sweet milk; and the butter made from this cream is usually sent to Paris, and obtains the highest possible prices, for the Parisians are famous for the quality of their butter. In other dairies the cream is allowed to sour, and is not taken off the milk until the latter has turned, and is frequently found in a state of curd. The farmers believe that they obtain a larger yield of butter by this means,—which is possible, considering that they must take up some curd with it,—and they find that it procures a fuller flavour, which is preferred by a certain class of consumers. This butter also keeps better if it is thoroughly well made, but not unless. Another system which we have seen adopted in the department of La Manche, is that of artificially souring the milk. The milk room is usually placed behind the kitchen, so that a communication can be made between the flue and the milk room. At a certain time in the day a tap is turned, and a quantity of hot air is sent into the milk room, which is at all other times exceptionally cool, and the sudden change turns the milk. In these cases we were astonished to find, upon lifting the cream in the pans with the skimmer, that the milk underneath was an absolutely thick curd, and it appears to us impossible that butter can be made without the introduction of a certain percentage of this. The farmer uses the curd for two

purposes: in some cases for his men, and in other cases for his calves; each calf being entirely fed upon it until it is fit for the Paris butcher, when it is sent up in the form of large veal. In churning, which practice is, generally speaking, conducted in time for the markets of the district once or twice a week, as the case may be, the barrel churn is almost invariably used, and in large dairies two are worked at the same time by means of a connection through the wall, with horse-gear outside. A number of different churns have at times been exhibited in these departments, but the farmers do not take to them, and the barrel may be seen everywhere. The churn is generally turned at a slow pace until the granular butter is formed; and much importance is attached to this, for the cleansing, and we may almost say, the working of the butter is conducted within the churn. This could not possibly be done if it were converted into lumps before churning was stopped. Where salt is used, it is almost invariably mixed with the butter in the churn, and any practical dairyman will, after a few moments' reflection, see that there can be no better opportunity of thoroughly amalgamating it by means of brine with the butter, than by pouring it into the churn while the butter is in this granular form. Every particle of butter-milk is washed out, and the butter can be salted to the greatest nicety by means of careful washing after the brining process, thus modifying the strength of the salt to the required taste. When this is done the butter is taken out, very slightly worked, and made up into huge lumps or cones, and placed in baskets of appropriate size, ready for market, or despatch by rail. Naturally, in some cases, it is put into pots either for the merchant or for shipment: in others it is prepared, as we have

frequently seen it in London shops, in pound or half-pound rolls, or in kilogrammes or half-kilogrammes. The churning process usually takes place in an apartment adjoining the milk room, also paved with stone, and plentifully supplied with water, these two articles being made a *sine quâ non* with the French dairy farmer. On the best dairy farms there is generally a drainage system for carrying waste milk and butter-milk into the pig-geries, although these are sometimes at a considerable distance.

Cheeses.—It might almost be said that the cheeses of France are more numerous than those of all the rest of Europe put together. We should not be surprised if this were the case: at all events the number is very large, although many of the cheeses are quite local and almost identical with those made in other parts of the country and known under other names. Pouriau, a recognised authority upon dairy-farming in France, names a large number of cheeses in his recent work, and divides them into two classes, hard and soft; the latter being sub-divided into new and ripe cheeses, and the former into, (1) pressed and salted, and, (2) cooked, heated, and pressed cheeses. New cheeses are found in almost every market in France, and in several forms. Thus they are made by large milk dealers in the cities from surplus milk which they cannot hope to dispose of in any other way. Small farmers manufacture them from skim milk and send them into the markets in a very tasty form at a very low price, while others with greater skill make new milk cheeses, or cheeses combined of new milk and cream, reaping good prices from these, and giving them names such as Bondons, Neufchâtel, Normandie, Malakoff,

double cream, etc. The perfected or refined soft cheeses, which are seldom sold until completely ripe, and which are both made and ripened, and purchased and ripened by the farmers, include those of Normandy—the principal of which are the Camembert, Livarot, Pont l'Evêque, Mignot—those of the departments of Seine, Marne, Oise, Meuse, etc., which include the Brie in its various forms, *e.g.*, the Brie de ferme, Brie courant, Brie de saison, the Coulommiers Brie—also the Troyes, Barberey, Eroy, and the Chaource; also imitations of both Brie and Coulommiers. Again, among numerous other soft cheeses popular in France are the Mont d'Or, the Port du Salut, the Rollot, Marolles, Langres, Void, the Géromé, St. Florentin, Olivet, Bourgogne, Macquelines, Thury, Munster, Compiègnes, and the Senecterre. Among these may also be included what are called *fromages à pâte ferme*, such as the Roquefort, the imitation Roquefort, the Septmoncel, Gex, Mont-Cenis, Sassenage, Cantal, Languiole, and a variety of other cheeses of the Auvergne. There are also Hollandes Française, or French-made Dutch, and fromage de Bergues, these being all pressed and salted. Among the remainder or really hard cheeses we have the Gruyère and its imitations, the Rangeport, Port du Salut, and the *fromages* of the Pyrenees, also a variety of others made from the milk of goats and sheep.

The descriptions in the sequel relate to a selected number of varieties which are at the head of their respective classes, and which are slightly varied in different departments.*

* See also "British Dairy Farming," illustrated by the writer of these lines, published by Chapman & Hall, in which this department is exhaustively treated.

Brie.—In the manufacture of the Brie cheese the rennet is added to the milk as the latter comes from the cow, and in a general way one particular make, that of Boll, is preferred rather than home-made rennet. Thus it is always of one strength, and a proper quantity can be added without difficulty. Eight twentieths of a cubic centimetre are used for each litre of milk. The mixture is set in a tin vessel holding about forty litres, and after being slightly stirred with a spoon it is left in a room at a temperature of 65° F. It may be added that in summer time, in spite of the evenness of the temperature, six twentieths only are required to obtain the same result. At the end of four hours the curd has become firm and elastic to the touch. It is then placed in moulds made of tinned iron; two being used for each cheese, and varying in diameter, some cheeses being twelve inches across, and others not more than half that size. The top mould fits into the bottom one, and the curd is filled to its rim so that when it has drained and sunk considerably this is taken off. The top mould is 2 inches, and the bottom $2\frac{1}{2}$ inches in depth. The curd is fit to move when the whey rests on the top quite clear and bright. For ladling it into the moulds a flat tinned iron plate slightly concave is used. The moulds stand upon small round boards called planchettes, upon which straw mats are laid, the boards being placed upon fluted benches made of cement, from which the whey drains off. At the end of 3 hours, when the top mould is taken off, a dry mat is placed on the top of the curd, and a clean board laid over this when the cheese in the bottom mould is inverted and left to drain for 8 to 10 hours. Next day fresh mats are used in the same manner, the straws being laid in a contrary way to those of the previous

day, so that the cheese is marked evenly on each side. The mould is next removed and the plain cheese left upon the sloping boards, having been first salted with very fine salt, sprinkled by the left hand and spread by the right, by means of a goose quill. At the end of 12 hours each cheese is laid upon a round willow frame called a *clayette*, which is placed on the top of the cheese, this being at once inverted and the mat beneath removed. The cheese is next taken to the drying-room, and salted on the rim and the outer face, and placed upon shelves to dry, plenty of air being necessary, and this should be passed through the room in as energetic a manner as possible. The cheese is turned morning and evening, a clean *clayette* being used each time. On the 2nd day a white mould appears in large patches, and when this has covered the face of the cheese it is taken to another apartment where the currents of air are stronger, but are regulated at will as it may be found necessary to hasten or retard the development of ripening. Here, the cheeses are placed upon dry mats resting upon boards and turned every 24 hours, the mats being changed each time. The mould becomes blue at the end of a month, when it is the custom of the farmers to sell the cheeses either for immediate consumption or for further ripening by the merchants.

Coulommiers.—In the manufacture of Coulommiers, which resembles Brie in almost every particular, the rennet should not be added at a temperature exceeding 77° F. The quantity per litre of milk is from 1½ to 3 twentieths of a cubic centimetre according to the season, the curd standing 36 hours in an apartment at 64° F. before it is touched, when it is softer and less elastic than

that obtained in the manufacture of the Brie. The remaining portion of the process resembles that of the Brie; but it may be added that the cheese is much smaller in diameter, ripens much quicker, and can in fact be eaten with greater relish on the eighth or tenth day from its manufacture, when the Brie at this period would be tasteless.

Géromé.—This is a soft round cheese, weighing from 4 lbs. to 8 lbs., and sometimes made with the addition of aniseed. The milk is coagulated at the temperature at which it comes from the cow, and is placed in a deep copper vat holding some 40 quarts, and covered with a lid, in the centre of which is a wooden funnel. To the bottom of this is attached a cloth for straining. The rennet, as in most cases in France, is home-made, and the quantity added varies according to its strength, which can be ascertained with a little practice. The curds and whey are divided with a ladle in half an hour, and the vat covered for a second half hour, when the division is continued until the curd has formed into small pieces about the size of a nut. When this has been accomplished it is taken out and put into cylindrical moulds 5 to 9 inches in diameter, two being used to each cheese, the one fitting into the other. The larger one is pierced with a number of holes for drainage. The height of the two moulds when fixed is about 14 inches. At the end of 12 hours the curd will have sunk into the bottom mould, when the top is taken off. It is now called a cheese, and changed into a fresh clean mould, and placed upside down upon a shelf. In 6 hours it is again turned, and it is twice turned during the two following days. When draining, the cheeses are

always put upon a sloping shelf from which the whey can run off. The temperature of the room in which they are made is about 60° F. Salting is next performed, the two surfaces being well sprinkled, and this operation is repeated every 3 or 4 days, the cheeses being turned each time. Turning is continued for 3 days after salting, and the surfaces moistened with tepid water. When a dry crust has formed, they are removed to the drying room, or *séchoir*, in which large numbers are kept in a small space, the aëration and temperature being perfect. When thoroughly dry, the Géromé cheeses are taken to the cave or ripening cellar, where they must be carefully managed. The largest remain here some 3 to 4 months, and are frequently turned and washed with slightly tepid water during the time. As soon as they are brick-red in appearance, and sufficiently firm to yield to the pressure of the finger, they are marketed. A good Géromé is firm, rich, and oily, with a few small holes in the centre, in this respect somewhat resembling Gruyère.

Livarot.—One of the most popular cheeses in France, and one which is not only profitable in its manufacture, but well adapted for production by our dairy farmers, is the Livarot, which takes its name from the town of Livarot in the department of Calvados, the principal centre of its manufacture. To the workmen, who consume immense quantities of it, it is almost indispensable. The milk taken from the cow is creamed on the following day and poured into large wooden tubs, holding about 50 gallons, being then brought to the temperature which it possessed on leaving the cow. The rennet is then added, in summer 1, and in winter 2 dessertspoonfuls being required for

every 6 gallons of milk. As a rule this is made on the premises, several calves' stomachs being cured together, for each of which a large spoonful of salt and 3 glasses of water are used. In 1 or 2 hours, the coagulation is complete, when the curd is broken up and laid upon rushes or a clean cloth. Before placing in the moulds, it is necessary that the curd should be reduced to small cubes no larger than lumps of sugar. After having been left to drain for a quarter of an hour, the curd is placed in the circular wooden moulds where it completely drains and attains a proper consistence. This result can be obtained in 3 or 4 hours if it is warmed, but the quality of the cheese will be impaired. Moreover it must not be left too long in the moulds—1 to 4 days, according to the season of the year and temperature, being quite sufficient. The moulds are turned over one hour after the curd has been placed in them, and this operation is repeated half-a-dozen times before the cheeses are released. They are salted with the hand and left for 4 or 5 days on inclined wood or stone tables, and then taken to the *hâloir*, or market. The *hâloir* is an apartment with windows let into opposite walls, through which a current of air passes for the purpose of desiccating the cheeses placed in them in various stages upon the lath racks, which have been previously covered with straw. In this place they are left for 15 to 30 days, and then taken to the cave, all the apertures of which are closed, and uniform temperature kept. In consequence of the gas given off from the cheese, the walls are not made of brick or stone, but of mortar mixed with chopped hay. The cheeses, placed on planks, are turned twice weekly in winter, and three times weekly in summer, being slightly wetted each time with pure water, and salted

afresh when necessary. At the end of 8 or 10 days in the cave they are set on their edges on a species of sedge to assist the process of drying. They remain in the cave for 3 to 6 months, according to their size, and, when packed for transmission to market, are coloured with anatto. It requires about 5 pints of milk to make a cheese; and September and October are the months chosen in which to commence the process of manufacture. Several makers of Livarot cheeses manufacture from 5,000 to 8,000 dozen in a season, besides purchasing many white ones to perfect in their own caves, which sell at $3\frac{1}{2}$ to $8\frac{3}{4}$ francs per dozen, and ultimately realise 15 to 20 francs, or, during Lent, 20 to 30 francs. At the Lisieux market, one of the best in the department, three varieties of cheese are sold—white cheese, which is eaten fresh and is most delicious, at 2*d.* retail, or 1.20 to 2 francs the dozen: Camembert of medium quality from 4 to 5.50 francs: and Livarot, which varies from 9 to 11 francs the dozen—while at St. Pierre about 1,000 dozen are sold in the market every week, at an average of 7 francs the dozen. At the markets of Vimoutiers, Livarot, Lisieux, St. Pierre, and at Lisieux Station, very large quantities are also sold; and, since 1866, the total value of the cheeses manufactured has more than doubled.

Journiac.—This cheese is made to resemble Roquefort, but instead of being manufactured from ewes' milk it is entirely composed of the milk of the cow. The following is the system adopted at the farm of M. Laforce, who resides some 3,300 feet above the level of the sea. When the milk comes from the cow it is poured into a wooden pan, made of fir, which will hold the milk from a hundred cows.

It is then carried to the cheese-room, and the rennet is immediately added. After the curdling and the separation of the whey are complete the curd is placed in cheese-moulds made of tinned iron, in which it is left to drain for three or four days, and afterwards carried to the cave, which is kept at a uniform temperature of 77° F., where it is constantly watched and attended to by special workmen. Every cheese is turned daily and frequently sprinkled with fine white salt. After a short time they are removed to other caves, which are much colder and provided with strong currents of air. Here they are stood upon their sides and pricked to the centre with needles in order to place in contact with the air a fine meal composed of rye, wheat, and barleymeal, which, at the moment of placing the curd in the cheese-moulds, was laid within the body of the cheese. This composition, when properly made, gives rise to the formation of a blue mould in the interior of the cheeses; and if the colour is of a fine blue it is classed as first quality, providing of course it is of equal taste. During the time the cheeses remain in the second cave they are daily rolled and scraped, in order to avoid spontaneous growth of fungi. They are usually ripe at the end of two months and despatched for sale in cases holding one dozen each.

Mont d'Or.—These very delicious small cheeses are made of new milk, either by the addition of the morning's to the evening's, or twice a day. The rennet is not added to the milk but the milk to the rennet, this being placed in the vessel in which setting is to take place. When thoroughly firm the curd is broken up and placed in single hoops, similar to those used for Coulommiers, these however being placed upon larger hoops, which are made of

wood, and on the top of these a couple of straw mats are laid to encourage draining and prevent curd passing through. The diameter of the metal hoop is from 12 to 13 centimètres and that of the wooden a shade more, the height of each being about 8 centimètres. When the moulds are filled, they are placed upon a fluted inclined shelf in order to drain, each cheese being turned at the end of two hours, when clean mats replace the wet ones. Next day the same process takes place, when they are carried to the *séchoir* for further drying; shelves covered with rye straw being provided for the purpose, and the cheeses being here taken out of the mould. Turning takes place four times a day, but there is no salting other than that which results from a continual damping of each surface with brine. When sufficiently dry, at the end of two or three days the cheeses are removed to the ripening room, where they remain for a week during warm, and a fortnight in cold, weather.

Roquefort.—It is only necessary to refer to the Roquefort cheese—to state that it is made of sheep's milk, that the system of manufacture is somewhat intricate, and that, as it is not likely to be attempted in this country, we do not deem it necessary to give a detailed description.

Neufchâtel.—This little cheese, which takes its name from the little town in the Brie district, in the department of Seine Inférieure, is largely imitated by milk dealers in London, who find the system a ready way for disposing of their surplus and sometimes spoiled milk. It is sold in both its ripe and white forms, as well as from poor and rich milk respectively: those made from skimmed milk being

largely consumed by the poorer classes. The milk is coagulated in vessels holding about 12 quarts, the rennet being added when the temperature is about 90° F. The pans are left from 36 to 48 hours, after which the curd is deposited in cloths which are hung to drain over square forms, the corners of the cloths being fixed to the corners of the moulds. It is next put into a dry cloth and slightly pressed for 9 hours or more if the whey is not extracted. It being now tolerably solid, it is placed in small cylindrical moulds, which give it its shape, salted at the ends, placed on planks in rows, and carried to the perfecting or ripening cellar. In a few days a white mould appears, and it is then ready for the market as a new cheese. If this is to be complete it remains much longer and is regularly turned. One pound of milk is estimated to make a cheese, so that as a gallon will make ten, and the poorest cheeses realise a penny each, the maker does remarkably well with his milk. Naturally the prices vary according to the quality, some makers preferring to add cream to the milk, while others use skim milk only. There are a variety of ways of manufacturing these white cheeses, whether they are to be ripened or not. In some cases a mould is used which resembles a small box about 3 inches high by 4 inches square, holes being pierced in the sides. In other cases a similar box is used, which stands upon four legs; and in others again a heart-shaped wicker frame is adopted, or a round mould of wood in which holes are similarly pierced. The curd of skim milk is used in several forms for the manufacture of fresh soft cheeses, and is even sold in its new state for that purpose. In some cases where it has been made at a temperature of 80° F., it is mixed with a small quantity of cream, and when the two are thoroughly amalgamated the mixture is put into small

moulds, and left to drain; but the curd must be particularly soft or the amalgamation will not be perfect. Sometimes, however, it is placed in fine cloths and hung over square moulds, or from the ceiling of the dairy. Little cheeses of this nature can be made in so many ways that it is not surprising the French take so much trouble to understand and manufacture them, and that we should be able to see such numbers of different varieties in their country markets.

Camembert.—Perhaps this is the most popular of any French cheese among English consumers. It was invented nearly a century ago by Marie Fontaine, ancestress of M. Cyrille Paynel, the most famous maker of the present day, whose farm at Mesnil Mauger we visited, to learn the process of manufacture, a few years ago. It takes its name from the *commune* of Camembert, in which Mdlle. Fontaine resided. The cheese is made from whole milk, and cream is not added as is popularly supposed. There are imitations made of partially skimmed milk, but they do not possess the quality of the real article. A portion of the morning's milk is added to the milk of the previous evening, this being heated in a tub to the temperature of 95° F. when the rennet is added, this depending chiefly upon its strength and the time of the year.

As an even quality of rennet is very important, some makers prefer to manufacture their own. M. Paynel uses one dessertspoonful to twenty litres of milk, and about fifty per cent. more in winter. When mixed, the milk is stirred for two or three minutes to assist its coagulation. It is then covered and left for between five and six hours according to the season, and when the finger can be laid upon the surface without curd adhering, it is ready for

work. The curd is next taken out with spoons, and placed in small cylindrical metal moulds, some four inches in diameter, in which the cheese is shaped. These are open at both ends, and stand upon small rush mats which are laid upon sloping tables with gutters at the ledge for carrying off the whey as it runs down from the cheeses. As a rule 2 litres of milk are required to make each cheese. After remaining all day in the moulds, the cheeses can be removed with ease. They are then turned, and the faces placed upon clean mats, the new faces being powdered with fine salt, and the cheeses left to drain until the next day. They are now taken out of the moulds, rapidly salted, placed upon wooden shelves, and left for two or three days until they are ready to send to the drying-room, where they are laid upon shelves covered with straw. This drying room, or *hâloir*, is specially designed to admit as much air as possible, the more energetic the current the better, although it must not be carried straight through from window to window but arranged so as to affect the whole apartment, as shelves are placed from top to bottom. The windows must also be covered with fine wire gauze to prevent the entrance of insects and dust. The cheeses must be daily examined while under the drying process, and turned or removed as may be required. They remain in this apartment from 20 to 25 days according to the season. If the weather is damp, the process must be hastened by admitting more air, otherwise they become too soft and are likely to spoil. During the first week, they are turned daily, and afterwards every other day. About the third day, small brown spots are seen upon the surface or skin, and in another week they become covered here and there with fine white patches, and as further days pass these change to a yellow, and then

to a reddish yellow. They are not removed until they have commenced to sweat and no longer stick to the fingers when touched. The next process is that of ripening in the *cave de perfection*, or curing cellar, which is an apartment with glazed windows and interior shutters arranged to prevent the entrance of the sun. The temperature must be mild—about 50° F.—and the apartment slightly humid. Too much moisture is not desirable, and the floors are often paved to prevent this. Shelves are built round the room, and upon these, cheeses are placed according to their age. As they are taken from the top, the lower tiers are removed up and space left for new cheeses as they arrive—a foot dividing each shelf. The cheeses remain here from 20 to 30 days, during which time the most constant attention is paid to them, for they are turned almost every day, and every phase of fermentation watched, and assisted or checked as may be found necessary. In some cases they are made all the year round, large dealers purchasing the cheeses from the smaller makers in their new state, and drying and ripening them themselves in their own specially prepared apartments.

The most imperfect ripening is that of summer, hence cheeses are seldom made by farmers during the hot months. When the process is complete, each cheese is wrapped in paper and packed away in sixes, and again wrapped up and packed in wooden cases or willow baskets in wheat chaff, and despatched to the markets. In the best season they reach 6*s*. 6*d*. to 7*s*. 6*d*. a dozen, but in summer they are often sold as low as 4*s*.—realizing, however, 10*d*. to 1*s*. each in the London markets. Upon the average, it takes 2 litres to make a cheese of 300 grammes or about 10½ ounces. M. Paynel uses 1000 litres of milk daily when

making Camemberts, and consequently turns out some 500 cheeses per day, these yielding him an average of 6*s*. 6*d*. a dozen. A good Cotentin cow is expected to give 3000 litres of milk or about 1600 cheeses, which, at 5*s*. 6*d*. a dozen, would be nearly £35. In the department of Calvados many farmers make from 10,000 to 160,000 cheeses each; while from the village of Mesnil Mauger, where M. Paynel resides, twenty-four makers in one season made 62,000 dozen.

Mignot.—This cheese receives its name from the family of Mignot, who were the first to make it. It is made in two varieties, the new or white cheese produced from April to September, and the Mignot *passé* from September to April, the latter being the more valuable. The milk of the morning is creamed in the evening, and mixed with the evening's milk. It is then heated until it slightly scalds the finger, when it is poured into earthen vessels and a spoonful of rennet added to every 40 litres. It is next placed near the fire, and left from 8 p. m. until 6 the following morning, being covered the while with a double cloth with a small hole in the top to prevent souring. The coagulation is very slow, but when it is effected, the work of manufacture is proceeded with, as in the case of the Pont l'Évêque with the exception that the Mignot is drained less than that cheese. In making the white cheese, the mid-day milk is skimmed in the evening, and mixed with the evening's milk, both being warmed as before mentioned. It is then placed in earthenware vessels and covered with a cloth until the next morning, when it is skimmed and used with the new milk of the morning, after which the rennet is added. The rest of the process is as for the Mignot *passé*, both cheeses being subjected to very slow drainage

of the whey. They are rapidly made, salted upon the evening of the day they are put in the moulds, dried almost without air, and despatched to market a day or two afterwards. When ripe, the Mignot has a rich golden colour, and resembles the Livarot and Pont l'Évêque in flavour. It is made in both round and square forms, and reaches 4*s*. to 5*s*. a dozen in winter.

Pont l'Evêque.—This popular little cheese is made in the district of the town from which it takes its name, between Lisieux and Honfleur. Its original name was Angelot, or, as some think, Augelot from the valley of the Auge Oise. It is now made in 3 qualities, according to the quantity of cream used in its manufacture. In the first quality the *fleurette*, or first cream, is added to new milk after milking; or with some makers pure milk is used alone. The second quality is made from the morning's milk, which has been added to the evening's milk after skimming; while the third quality is made from the skim milk of 3 milkings, without any addition of new milk. In autumn 4 milkings are sometimes mixed, but in summer seldom more than 2; while in winter 5 and even 6 are occasionally used. In making cheeses from new milk, the latter is placed upon the fire until luke-warm, when the rennet is added, and as in the case of the Camembert, just sufficient is used to cause coagulation, too much giving a disagreeable flavour, and causing too active a separation. No rule as to quantity can be given, this being ascertained only by practice, with the particular rennet. The milk is stirred with the hand, and left for about 15 minutes, when the whole becomes set. It is then cut to the bottom of the vessel with a wooden knife, and left 5 minutes after

being covered with a cloth. The curd is next taken out, and laid upon reed mats, called *glottes*, where it is left to drain for a short time. The square moulds, made of ash or beech, are then filled with curd and placed upon the same mats until drainage is complete, these being turned several times during the half hour following the operation, and many more times during the day. After being continually placed upon fresh dry mats of a similar kind, in 48 hours, the cheeses are taken from the mould, and salted with fine dry white salt. One side is salted in the morning and the other in the evening, only a small quantity of salt being used. They are then taken to the *séchoir*, or drying-room, and placed upon long shelves suspended from the ceiling. This apartment is aired or ventilated, as described above. The cheeses remain equi-distant from one another for 2 or 3 days, and are turned only once a day, and when dry they are carried to the ripening cave or cellar, and laid close to each other in boxes, this close proximity being supposed to assist their ripening. Great care must, however, be exercised: they must be frequently examined, and turned over every 2 days, and afterwards stood upright, and finally flat one upon the top of the other. They remain from 3 to 4 months in this apartment, according to their size and quality; the richest remaining for a less period than the poorest, and if these are small and thin, 15 to 20 days is often sufficient to perfect them. Poor cheeses which are kept for a long period, sometimes become too hard, when they are enveloped in a cloth damped with whey, this process making them more tender. A well-made Pont l'Évêque cheese retains its qualities for a year, and even two years if properly taken care of; but it must be prevented from coming into contact with

damp and too much air. The richest cheeses are made in the autumn, the midsummer cheeses being generally from milk which has been skimmed for butter-making. This cheese has a tendency to harden, but this is prevented in a great measure, by the addition of a little boiling water in the milk when it is put together. Milk used for the manufacture of this cheese in summer must not exceed a lukewarm heat, or it will become too hard, whereas in autumn and winter the makers prefer that it should slightly burn the finger.

In making the second quality of cheese, a litre of boiling water is generally added to 6 or 7 litres of milk, a little more being used in autumn than in summer. In making the third quality the makers simply boil the water which is poured into the milk, the latter not being heated at all. Great care, however, is needed, as old milk is liable to turn. This cheese must be eaten quickly, as it will not keep more than about 3 months, but otherwise it is almost as fine as cheese made from whole milk. It becomes a velvety blue in 3 weeks, shewing that it is ripe, when it should be at once marketed. To make a good cheese valued at 1*s.* 3*d.* 4 litres of new milk are required; and 5 to 6 litres for a two-franc, or 1*s.* 8*d.* cheese: thus 4 litres valued in England at about 7*d.* produces a cheese worth double the money, in addition to the whey, which would increase the return. The richest of these Pont l'Évêque cheeses, called "Bespoken" and made of two-thirds whole milk and one-third cream, are seldom marketed, but reach from 30 to 40 francs per dozen, and are found upon the tables of the rich in Paris, and other parts of France. Many of the farmers in the district manufacture from 4,000 to 5,000 cheeses per annum.

St. Marcellin.—This cheese is made from goat's milk, unskimmed, and derives its name from the district in which it is made. The cheeses weigh from about 4 to 4½ ounces, and, if eaten fresh, must be consumed within twenty-four hours. In hot weather they are considered particularly agreeable, though called cheeses of the third quality.. The rennet is manufactured according to the custom of each particular farmer, but is generally made from calves' vells and white dry wine. No definite rule can be given as to the quantity to be used, as this varies with different makers, and according to its strength, but a little practice will determine this point. If too much is used the cheese becomes slightly sour. In winter the milk is heated a little before working commences, but not in summer. When the milk is curdled, it is placed into small goblets or mugs, holding about 2 pints, which are perforated all over the surface. In these the curd is placed, and after it is sufficiently drained, and unable to lose its form, it is quickly salted, taken from the moulds, and placed in an apartment upon a shelf, on which is a layer of rye straw. This apartment must be well aërated, and in a sheltered position, and the cheeses turned and salted daily during the hot weather: once every 2 days being sufficient in the cold season. When they commence to dry, the crust assumes a yellowish colour, and then a blue: and in this state may be marketed as cheeses of the second quality. In order to make a more perfect article the cheeses are placed in a closed compartment in a cellar, being always placed upon straw. Here they take a blue, and then a yellow mould, and are considered to be of the best or first quality. The chief feature in the manufacture of the St. Marcellin cheeses is, that the most rigid cleanliness in

every operation is observed. The second and third qualities of these cheeses can also be made from unskimmed cow's-milk, while good cheeses may be manufactured by adding to the goat's milk 25 per cent. of milk from the cow. It is questionable, however, whether we in this country can make so tasty an article in the absence of the peculiar and exceptional pasturage cultivated by the French farmers of the district in which this cheese is made.

St. Remy.—The milk and rennet are put together for the manufacture of this cheese at a temperature of 95° F.: 10 to 12 grammes—a third or a little over a third of an ounce—of rennet being used for every 100 litres of milk. If the milk is not set direct from the cow, it must be warmed until it reaches the required temperature. St. Remy cheese is sometimes made from mixed milk, and sometimes from new milk, according to the system of the maker. The curd is usually formed in from 20 to 25 minutes; but if at the end of this time it is not fit for use, a small additional quantity of rennet is added, without re-warming the milk. When firm it is cut into pieces with a utensil made for the purpose to assist the separation, and it is then left for half-an-hour, after which the whey is removed and the curd placed in the moulds, which are allowed to stand upon a sloping table until late in the afternoon, or 6 or 7 hours from the time of commencing the work, when they are turned and left to drain until the next morning. They are then salted for the first time, and again turned and left for 24 hours. Next day they are again slightly salted, and when fairly dry are placed upon small plates or dishes, and stood upon shelves and turned 2 or 3 times

daily; the plates, which are of wood, being moistened each time. If they become at all hard they are washed with lukewarm skim milk, with the aid of a brush. When thoroughly drained they are put upon drying shelves until quite dry, and fit for the refining cave; but before being taken here they are usually passed through some fresh water whatever the season of the year may be. When in the cave, which is a particularly cool cellar, they are washed at least twice a week in summer with a brush, care being taken to remove all mouldiness as it appears; but the washing is not needed so much as they proceed in the ripening process.

GERMANY.

There are a variety of systems in force in the different countries of which this nation is composed, but it is not necessary to refer to any other than the North German one, for in South Germany butter-making as well as cheese-making is conducted in an old fashioned manner, and would afford no instruction to the modern dairy farmer. North Germany is becoming a famous dairy district, more especially since the first factory was built at Kiel, this having been but the precursor of many others which are now in full work in various parts of Sleswig, Holstein, Brunswick, and Hanover. Perhaps the most intelligent portion of North German dairying is in connection with these factories, to which the farmers send their milk for conversion into butter and cheese, and receive a sufficient sum to pay them well for their trouble. Home dairying in Germany is neither advanced nor especially intelligent, and cannot compare with that of

either France or Denmark; but scientific dairying is equal to that of either country, for perhaps German scientists in this department have no superior in Europe. As in Denmark, it is the custom in the factories to manufacture butter which is sent out in little round pots with covers, and which hold a kilogramme (a little over 2 lbs.); these being usually salted, when they will keep for a length of time. The butter is invariably made from cream which has been soured whether it has been separated by the centrifugal machine or raised in the Swartz vat; and it is almost invariably churned in a vertical churn known in this country as the Holstein. As a general rule, the farmers who conduct their own dairies, churn until the butter has become solid, when they fail to thoroughly cleanse it, and often salt it too highly. The Germans, however, like a well developed flavour, and scarcely realize that they are behind neighbouring nations in dairy management. In all the factories a proper system is conducted, the milk heated and cooled after its arrival, skimmed by the Danish, Laval, Lefeldt, or Fesca machines; and the skim and butter-milks largely used in the manufacture of cheese. All factories sell cream neat in two qualities, as is sometimes done in London; and they also sell skim-milk and butter-milk to the poor, their vans being seen in every large city, with the taps of the cream, and new skim, and butter-milk, outside, with the prices of the day painted over each. The Germans also use their butter-milk for their horses, for which it is a valuable food, and pays much better than giving it to pigs. Pigs, however, are largely kept for the purpose of consuming the whey and such milk as cannot otherwise be disposed of. There is perhaps more care taken to prepare foods for the

poorer classes than in any other dairying country; for, in addition to the milk above mentioned, curds are largely sold at 1¼*d.* a pound, much of which is made from butter-milk, while skim-milk sells at 3½*d.*, and butter-milk at 5*d.* a gallon. The principal cheeses made in Germany are also particularly adapted for consumption by the poorer classes, and of these we may name specially the Limburg and Backstein; the latter being made in varieties known as Lab käse, Hartz käse, and Sauer käse, although there are a variety of sour cheeses made in Germany.

The Limburg Cheese, which is also largely made in Belgium, and which is almost the only dairy product at all famous in that country, is manufactured from skim-milk, and realizes in North Germany about 2½*d.* a pound to the maker, selling retail at 3*d.* each. It is made from milk at a temperature of about 95° F., sufficient rennet being added to set the curd in 40 minutes. There is no great art in its manufacture, for immediately it is fit to work, the curd is ladled out of the vat and placed in the moulds upon a table made for the purpose. This table may be 2 yards long by 2½ feet broad, one end being higher than the other. It is divided by movable partitions, which may be made of wood or tin, so that when these are placed in there are a number of moulds or divisions four inches square. These divisions are perforated, and along the bottom of the table are very small fluted channels for carrying off the whey. Sometimes the curd is placed in the tables before the divisions are inserted, these being placed in the curd when it has become firm. On the following day the cheeses are formed, taken out and salted, being turned several times for three days upon the shelves

upon which they stand, when they are taken to the drying-room, and remain sometimes for a considerable period. Occasionally the Limburg is sold fresh, but it may be kept until thoroughly ripe, at the end of two or three months, when it obtains a higher price. 100 litres of milk (22 gallons) usually make 8 kilogrammes (about 18 lbs.) of cheese.

The Hartz Käse is made from skimmed sour milk at a temperature of 90° F., the whey being completely separated from the curd by the process. At the end of a few hours the curd is dipped out of the vat and placed on a similar table to that used for the Limburg, but in addition it is pressed by weights which are put upon the top of each cheese. In a short time the curd is then placed in a mixing tub and salted at the rate of 1 ounce to 3 pounds. It is then ground, worked, and once more placed in the moulds upon the table. They are again slightly pressed, and then taken out of the moulds and put upon the shelves of the cheese-room to dry, being turned at first twice a day, and afterwards once only. They are then taken to the curing-cellar; but unlike the French, who encourage a growth of fungus, this is destroyed as rapidly as it appears, by being brushed off.

Backstein.—There are a variety of systems by which this cheese is made, although they do not differ much; but it is manufactured either from skim or half-skimmed milk at a similar temperature to the Limburg, being also converted into curd in the same period of time. After setting, instead of being immediately placed on the cheese-table, it is cut up into cubes to allow the whey to drain, and afterwards again cut into cubes for the same purpose. It

is next placed in the wooded moulds similar to those used for Limburg; and when sufficiently drained, each cheese is taken out and treated in a similar manner to that we have described above for the Limburg. There are also a variety of cheeses known by other names made in North Germany, but the manufacture is similar to that already described. In the South, however, there are a few kinds which need not be referred to, as they resemble in almost everything but name those which we have described as being made in France and Switzerland.

HOLLAND.

The chief dairying districts in the Netherlands are North and South Holland and Friesland, each of which has its spécialité. In the first, the famous Edam or round Dutch cheese is manufactured, together with the almost equally well-known Campine butter; in the second, the flat Dutch or Gouda cheese is a staple industry in addition to the butter of Delft; while Friesland is, perhaps, more famous than either for its butter, one port alone in this country having exported 400 tons in one season. In North Holland it is the custom of the dairy farmers to sell their worst calves at a month, rearing the best for the dairy, and it is remarkable that throughout Holland larger numbers of cattle are kept per acre than perhaps in any other dairying country. The system of setting milk is, generally, similar to that in England by means of the open pans, although in many cases the Swartz system is fashionable. In South Holland the best farmers expect to realise 660 gallons of milk per cow, one gallon making a pound of cheese; and we are not surprised at this, for the size and

milking qualities of Dutch cows are generally known. In the best dairies it is customary to skim at 12 hours to make the first quality of butter, and at 24 for the second, but 24 and 36 hours' skimming are most frequent with the smaller farmers.

In the manufacture of Delft butter the milk is first cooled in copper vessels, which stand in very cold water for 2 hours. It is then transferred into shallow pans in a cool dairy, skimming taking place at 12, 18, and 24 hours. The churns used are exceedingly primitive and much inferior to those adopted in this country. The working is done by hand, and the salting and packing exceedingly well-managed; but as a general rule it is not thoroughly well-washed nor too carefully made. Although an immense quantity of butter is imported into this country from Holland, there is very little of high quality, or such as our makers need attempt to imitate, the greater part of it being an imitation, in the art of producing which the Dutch seem to have long taken the lead, for there are numerous factories in Holland, and large quantities of poor butter, especially Campine, made for the purposes of mixing with and giving a character to, the imitation.

Edam.—The most famous dairy products of Holland so far as British consumers are concerned, are the Edam and Gouda cheeses. The former is the round, red Dutch, and is made as follows:—The rennet is added to the milk at a temperature of 90° F., and in 20 to 25 minutes, it is cut with an instrument resembling a lyre with a dozen strings. After standing for a short time for the separation to take place, the whey is taken out and the curd afterwards thoroughly worked by the hand; and, when fit, it is placed in the

moulds which, in the case of this cheese, being globular, are divided into halves. The moulds, being full, are placed together, and pressed as tightly as possible. The solid curd is then taken out, a cloth wrapped round it, placed in fresh moulds, and subjected to pressure in a lever press until the next day. The moulds are placed in dishes to catch the whey, and the same pressure is generally made to answer for several cheeses. At the end of this time the cheese cloth is removed, and the cheese placed in a semicircular mould with a foot to it, and several holes perforated in the sides. A piece of flat board is then placed on the top, and it is then put under the press. After sufficient pressure has been obtained, the cheeses are salted and turned daily for 8 or 10 days, at the end of which time they are soaked in water and rubbed over with linseed oil.

Gouda.—In the manufacture of the flat Dutch or Gouda cheese there is some similarity to the Edam system; the rennet coagulating the milk in about 40 minutes, after which time the curd is gently cut and the whey allowed to separate for 10 minutes, when it is again manipulated; and after another rest the curd settles at the bottom of the vat, and the whey is drawn off. Hot whey is next mixed with the curd to sustain its warmth, and it is again allowed to remain for a short time, when this is taken out with a utensil specially made for baling. The curd is afterwards well-worked and evenly broken up. It is then pressed in the bottom of the vat and again broken up, as a mill is not used. It is afterwards placed in perforated moulds (being previously covered with cloth) which are immediately put to press, the pressure being increased

regularly until the following day, when it is turned and provided with a clean cloth. The cheeses are then laid in salt and water, where they remain for 8 days, after which they are washed with whey and taken to the drying-room. Here they are placed upon shelves, and daily turned until the second week, when turning is performed every other day. At the end of a month they are fit for sale, but it is the custom of some of the better makers to keep them for a much longer period, when the flavour is considerably improved and the consistence is more mellow. The Gouda cheese is generally made of new milk but, as in all cheeses, there are many farmers who skim the milk once before they set it to curd.

ITALY.

Butter-making in Italy is not conducted upon a principle which can by any means be termed modern or perfect. Upon small farms, the cream, which is raised in open pans, often made of wood, is churned in cylindrical churns, the beaters within being turned instead of the churn itself. This is the general custom in Lombardy. In Piedmont it is quite common for the farmer to place his cream at 50° F. into a round box, called a *Purragie*, which has a kind of spoon attached to the axle. This is turned by a crank and the revolution of the spoon is upon the inside of the periphery of the box. This process is rather laborious and requires the services of two men. "The dairyman of Parma," we are told, "beats his milk with a cream whipper, and skilfully lets the floating cream, which gathers into a bucket, overflow into a fine-edged wooden bowl and thence into the churn." In summer 10 pounds of ice are

added to 30 quarts of cream, while in winter the cream is heated, the temperature being usually kept at from 57° to 67° F., the Italians permitting a pretty wide margin. When in the churn the cream is beaten by two men alternately with a butter beater attached to a frame, this being raised and lowered by leverage. The butter forms in about 40 to 45 minutes, water being added if formation is desired quickly, and ice if it is necessary to retard it. The butter is worked by hand, formed in large lumps, and left to drain. In some parts of Italy it is customary to keep butter in bladders, a method which is considered very convenient, and which enables it to be kept for a length of time.

Cheese factories abound in Italy, and numbers have been started since the year 1873-74, when the Government offered large prizes and gold medals to the best-managed associations. In Sicily, strange to say, small dairymen, instead of daily manipulating their own milk, take it to the large cow-keepers, until they have delivered some 300 quarts. They then receive that quantity back at one time and deal with it in the manufacture of butter or cheese, this system of reciprocity being found mutually beneficial. The Italian cheeses known in England are the Parmesan and the Gorgonzola, the last-named of which the writer has visited Lombardy to see in course of manufacture.

Gorgonzola.—In making this cheese the milk is coagulated while warm from the cow, great attention being paid to the preparation of the rennet, and the quantity required being only ascertained by experience. The curd is set in from 15 to 20 minutes. The whey is then separated as much as possible, and the curd hung up to drain in coarse

strainers. This process is conducted twice daily after each milking. The curd which has been dealt with in the morning, and which is placed in round wooden flexible moulds, in which a cloth is first laid, is placed upon an inclined table, upon which the chaff of some rye has been laid. By the time the evening's curd is ready that of the morning is naturally cold, but the cheese is composed of the two, the cold curd being placed in the centre and the warm at the top and bottom. Thus each cheese is made up of three layers, and as the hot and cold curd never properly combine, two sets of interstices are, as it were, created, in which, as it matures, the well-known green mould forms, and adds to the cheese the delightful flavour which is so much approved of in this country. During the first day of manufacture the curd is turned three times, and on the next morning it is put into a clean cloth and salted, this process being continued for at least a week, sometimes more, and 1 ounce of salt generally used to about 8 pounds of curd. In some cases the salting operation is conducted by a special process of turning and pressing against a salted surface, this giving a better crust to the cheese. The wooden mould within which the curd was placed in the first instance is not removed until the fourth day, when the cheese has commenced to ferment. At the end of 25 days a good cheese is generally a pinkish white in colour; but if it is inferior it becomes nearly black, the crust in this case being soft, and the body of the cheese rapidly deteriorating. If, however, the crust is hard, washing in brine will improve it. The temperature of the cheese-room is usually between 57° and 67° F. The ripening commences in April and frequently continues until August. One gallon of milk usually makes 1 lb. of Gorgonzola cheese.

The Parmesan, or *Formaggio di Grana*, cheese is very largely made in Italy. In its manufacture the milk is heated, according to its condition and age, from 77° to 86° F., although this is somewhat guess-work, for the distinction is invariably made by hand. The rennet is then added in the proportion of a ½ ounce to 500 gallons. This rennet is dissolved by using a pestle in small wooden utensils made for the purpose, and filtering it through fine sieves, through which it oozes into the milk vat. The curd, having formed, is broken with a utensil called a *rotilla*, a disc being at the bottom end. The working is continued for forty minutes, with intervals every now and then, that the curd may be consolidated but not hardened. When the whey is removed, ½ an ounce of saffron is added to the contents of the vat per 80 gallons. The pan containing the curd is next placed upon the fire and heated for nearly an hour up to a temperature of 112° F., being stirred during the time with the utensil named above. When the curd has broken up into minute particles it is removed from the fire and a quantity of the cold whey, which had been drained off, is added to the mixture to assist the curd in forming in a mass at the bottom, where it is gathered and squeezed with the disc of the rotilla. It is then loosened and drawn to the surface, where it is collected in a cheese cloth, and lifted out into a mould and there left in its wet state for an hour. After this it is placed in a box made of beech and bound with hoops. A cloth is placed over it, and a wooden follower, upon the top of which heavy weights are laid. In this state the whey is pressed out; but, after a few hours, it is again dipped in the whey, but returned to the mould after being enveloped in buckram,—this, by means of the pressure, giving the cheese the peculiar print which is always

seen upon its crust. After some hours it is salted and then dipped in salt water and again pressed between the boards. The salting process is continued every other day for a fortnight, when it is taken to the curing-room and occasionally scraped, being finally well rubbed with oil.

There is a cheese made in various parts of Italy similar to the whey cheeses which are made in two or three English counties. This is called Ricotta. The curd, if we may so call the solids obtained from the whey, is the solid matter remaining in the milk after the extraction of the casein and fat. This is sometimes placed in a vessel of cold water, well shaken, and afterwards pressed with the hand. In half an hour the surface of the water is covered with a scum. This is the fat or butter of the *ricotta*. In making the cheese, the whey is boiled, a little of the sour whey from the last making being first added. In this process, a scum also rises which may be used at once in the form of butter or converted into a regular cheese. It may be improved by several modes of salting and curing, or by the addition of sweet milk or cream.

SWITZERLAND.

Dairy farming in Switzerland is an important national industry; but in the mountainous cantons which are shut off from the outer world for almost half of the year, and where the cattle graze, and the cheeses are made at an altitude of some 7000 feet, the system is exceedingly primitive. In these districts it is customary for one or two men to take the entire cattle of the valley to the mountains for the summer, to live with them, milk them, and make the cheeses, a hut being provided for the purpose.

Once a month the owners below visit the herds and test the quantity of each cow's yield; and by this means the cheeses are divided, and the herdsmen paid. In the more fertile cantons, such as Zurich, Zug, Lucerne, and Schwytz, the young cattle are grazed upon the mountains, but the cows are housed the whole year round, getting grass during summer and hay during winter, cake and corn being almost unknown to the farmers. The milk is usually set in shallow wooden pans similar to the English, for almost every dairy utensil is made of wood in Switzerland. The cream is churned sweet, the churns resembling a *Gruyère* cheese or a small millstone in shape, and they are consequently difficult to manipulate and impossible to clean. The butter is exceedingly good and seldom salted, but it must be eaten fresh, for it will not keep. In cheese-making, unless in the factories and on the best farms, the milk is turned by a primitive kind of rennet made of vinegar and sour whey in which pieces of bread are placed; and except the very beautiful copper cheese kettles, the finest appliance of the kind which we know, there are no good dairy utensils made in the country. The principal cheeses are—Emmenthaler which we call Gruyère; Gruyère, which in the country is often a real skim milk cheese; Vacherin; and Schabzieger.

Emmenthaler.—In this manufacture the milk must be at a temperature of from 93° to 96° F. If, however, the milk is extra rich, it may be a degree higher, whereas, for poor milk it should be a degree lower. Again, as in summer cooling is slower than in winter, it is not necessary that the temperature should be quite so high. The quantity of rennet added is usually 3 lbs. to 650 or 700

lbs. of milk, this rennet however being specially prepared by each maker. At the expiration of from 20 to 40 minutes, the curd has become firm and gelatinous, and manipulation then commenees. In the first place it is cut through slowly and regularly with a wooden knife called a *sabre de bois* which reaches to the bottom of the kettle. It is then left for a short time for the whey to divide from the curd, and afterwards heated afresh to a much higher temperature before it is again cut up. The breaking of the curd continues for some time, until at last it is entirely disunited from the whey, gets harder, and formed into small grains. The operator then takes a large cloth, stretches a metal band across one end, and this he dips to the very bottom of the kettle beneath the curd, which is ingeniously gathered into the cloth. The metal band is then disengaged, the four corners of the cloth affixed to a hook suspended over the vat, and the whole is immediately swung across and dropped into the centre of a huge *gruyère* hoop which is placed upon a table. Here it is worked into shape, cleverly covered with dry cloths, the hoop pulled tightly, and the cheese well bound within it. It is then placed in the cheese press, where it remains for about three hours, a pressure of eighteen pounds being devoted to each pound of cheese. After this, it is taken out and provided with clean cloths and again pressed, the changing of the cloths taking place four, five, and even six times during the day. The next morning the cheese is again taken out and placed upon a table for salting, being first well scraped or pared. The salt is laid upon the surface, and well brushed in with a brush provided for the purpose, about 4 lbs. of salt being used for 100 lbs. of cheese. It is then taken to the cheese-room and placed upon a shelf, and here it is

that it is either perfected or spoiled, for if the temperature is too low, it becomes hard and solid, and, if too high, it swells and large holes are formed within. If, however, the maker tests each cheese with his finger daily, there is little fear of any being spoiled.

Gruyère.—Gruyère in Switzerland is a half-fat cheese, the evening's milk being skimmed and then added to the milk of the morning, the latter being heated to a temperature of 110° F. before the addition of the evening's milk, so that the mean temperature of the mixture is about 93° F. before the rennet is added. The system of adding rennet is controlled by a simple experiment which the maker employs, adding 1 spoonful to 3 spoonfuls of milk before the bulk of the milk is touched. If this minute quantity sets in 60 to 80 seconds, all well and good, and he is satisfied of the strength of the rennet. As a general rule, the proportion is 1 part rennet to 140 parts of milk. When set, the curd is cut, as in the case of the Emmenthaler. The remainder of the system of manufacture very much resembles that described above. A hundred pounds of milk usually make 8 to 11 lbs. of Emmenthaler cheese, or 5 lbs. to 6 lbs. of the poorer Gruyère.

Vacherin.—The Vacherin cheese is chiefly made in Canton Fribourg. New milk is heated to a temperature of 100° to 104° F., and after the curd has set, it is gently divided with a net made for the purpose, and left for an hour, when the whey will be found at the top of the vessel. This is then baled out and the curd placed in a mould, in which it is left to drain for 15 minutes, being wrapped in a cloth and slightly pressed. The cheese is turned, and

the cloth changed four times during the day, in order that the whey may be completely pressed out or absorbed. It is taken out of the mould the next day and laid upon a clean cloth and left to dry and ripen, being turned and the cloth changed every second day.

Schabzieger.—This cheese, which is famous in some parts of Switzerland, is chiefly made from the albuminous portions of the milk called *séré*, and also from the curd of skimmed milk; and strange to say, the more completely the milk is skimmed the more successful is the manufacture of the cheese. The milk is heated until boiling point, when a quantity of cold butter-milk is added, little by little. Next a small quantity of *azi*—a prepared sour butter-milk—is added, and the mixture removed from the fire. Coagulation will now have taken place, and the mass is stirred with a large spoon, and after being allowed to stand for a short time the solid portion is taken out and placed in boxes prepared for the purpose, pressed, and then subjected to a heat of 60° F. in order to start fermentation. This is but the beginning of the manufacture, for it is allowed to ferment for some weeks, when the cheese is ground and salted, and a small portion of herb named *Melilotus cœrulea* which is finely pulverised, added, to impart the well-known flavour of the *zieger*. The cheese is now beaten, and made up into very small conical shapes. It is estimated that 30 lbs. of skim-milk make 3½ lbs. of schab-zieger, which is not eaten as is ordinary cheese, but mixed with butter, and spread upon bread.

INDEX.

BRADBURY, AGNEW, & CO., PRINTERS, WHITEFRIARS.