

**CIHM  
Microfiche  
Series  
(Monographs)**

**ICMH  
Collection de  
microfiches  
(monographies)**



**Canadian Institute for Historical Microreproductions / Institut canadien de microreproductions historiques**

**© 1998**

## Technical and Bibliographic Notes / Notes techniques et bibliographiques

The Institute has attempted to obtain the best original copy available for filming. Features of this copy which may be bibliographically unique, which may alter any of the images in the reproduction, or which may significantly change the usual method of filming are checked below.

- Coloured covers / Couverture de couleur
- Covers damaged / Couverture endommagée
- Covers restored and/or laminated / Couverture restaurée et/ou pelliculée
- Cover title missing / Le titre de couverture manque
- Coloured maps / Cartes géographiques en couleur
- Coloured Ink (i.e. other than blue or black) / Encre de couleur (i.e. autre que bleue ou noire)
- Coloured plates and/or illustrations / Planches et/ou illustrations en couleur
- Bound with other material / Relié avec d'autres documents
- Only edition available / Seule édition disponible
- Tight binding may cause shadows or distortion along interior margin / La reliure serrée peut causer de l'ombre ou de la distorsion le long de la marge intérieure.
- Blank leaves added during restorations may appear within the text. Whenever possible, these have been omitted from filming / Il se peut que certaines pages blanches ajoutées lors d'une restauration apparaissent dans le texte, mais, lorsque cela était possible, ces pages n'ont pas été filmées.
- Additional comments / Commentaires supplémentaires:

L'Institut a microfilmé le meilleur exemplaire qu'il lui a été possible de se procurer. Les détails de cet exemplaire qui sont peut-être uniques du point de vue bibliographique, qui peuvent modifier une image reproduite, ou qui peuvent exiger une modification dans la méthode normale de filmage sont indiqués ci-dessous.

- Coloured pages / Pages de couleur
- Pages damaged / Pages endommagées
- Pages restored and/or laminated / Pages restaurées et/ou pelliculées
- Pages discoloured, stained or foxed / Pages décolorées, tachetées ou piquées
- Pages detached / Pages détachées
- Showthrough / Transparence
- Quality of print varies / Qualité Inégale de l'impression
- Includes supplementary material / Comprend du matériel supplémentaire
- Pages wholly or partially obscured by errata slips, tissues, etc., have been refilmed to ensure the best possible image / Les pages totalement ou partiellement obscurcies par un feuillet d'errata, une pelure, etc., ont été filmées à nouveau de façon à obtenir la meilleure image possible.
- Opposing pages with varying colouration or discolourations are filmed twice to ensure the best possible image / Les pages s'opposant ayant des colorations variables ou des décolorations sont filmées deux fois afin d'obtenir la meilleure image possible.

This item is filmed at the reduction ratio checked below /  
Ce document est filmé au taux de réduction indiqué ci-dessous.

	10x		14x		18x		22x		26x		30x	
									✓			
	12x		16x		20x		24x		28x		32x	

The copy filmed here has been reproduced thanks to the generosity of:

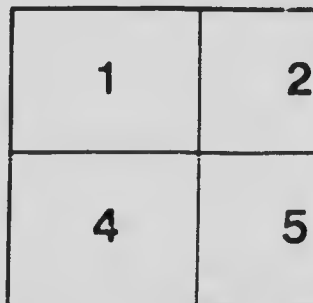
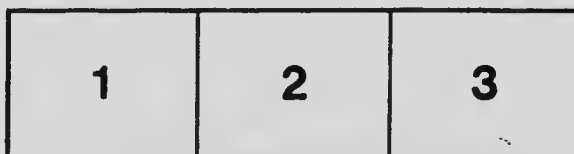
Library  
Agriculture Canada

The images appearing here are the best quality possible considering the condition and legibility of the original copy and in keeping with the filming contract specifications.

Original copies in printed paper covers are filmed beginning with the front cover and ending on the last page with a printed or illustrated impression, or the back cover when appropriate. All other original copies are filmed beginning on the first page with a printed or illustrated impression, and ending on the last page with a printed or illustrated impression.

The last recorded frame on each microfiche shall contain the symbol  $\rightarrow$  (meaning "CONTINUED"), or the symbol  $\nabla$  (meaning "END"), whichever applies.

Maps, plates, charts, etc., may be filmed at different reduction ratios. Those too large to be entirely included in one exposure are filmed beginning in the upper left hand corner, left to right and top to bottom, as many frames as required. The following diagrams illustrate the method:



L'exemplaire filmé fut reproduit grâce à la générosité de:

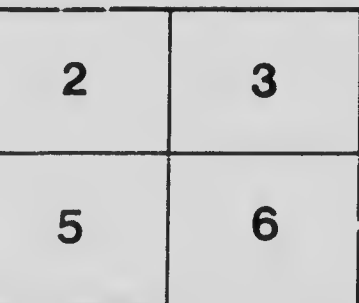
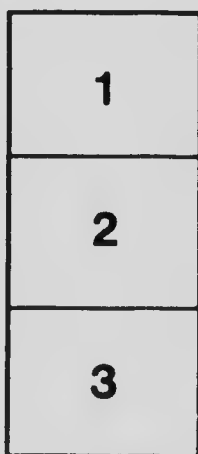
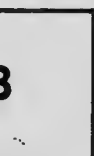
Bibliothèque  
Agriculture Canada

Les images suivantes ont été reproduites avec le plus grand soin, compte tenu de la condition et de la netteté de l'exemplaire filmé, et en conformité avec les conditions du contrat de filmage.

Les exemplaires originaux dont la couverture en papier est imprimée sont filmés en commençant par le premier plat et en terminent soit par la dernière page qui comporte une empreinte d'impression ou d'illustration, soit par le second plat, selon le cas. Tous les autres exemplaires originaux sont filmés en commençant par la première page qui comporte une empreinte d'impression ou d'illustration et en terminant par la dernière page qui comporte une telle empreinte.

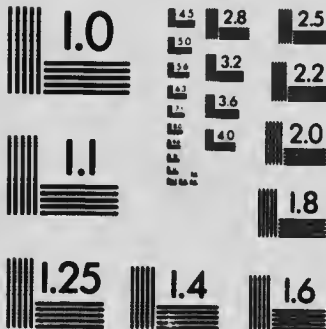
Un des symboles suivants apparaîtra sur la dernière image de chaque microfiche, selon le cas: le symbole  $\rightarrow$  signifie "A SUIVRE", le symbole  $\nabla$  signifie "FIN".

Les cartes, planches, tableaux, etc., peuvent être filmés à des taux de réduction différents. Lorsque le document est trop grand pour être reproduit en un seul cliché, il est filmé à partir de l'angle supérieur gauche, de gauche à droite, et de haut en bas, en prenant le nombre d'images nécessaire. Les diagrammes suivants illustrent la méthode.



# MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)



**APPLIED IMAGE Inc**

1653 East Main Street  
Rochester, New York 14609 USA  
(716) 482 - 300 - Phone  
(716) 288 - 9889 - Fax

EXHIBITION CIRCULAR No. 28.  
DOMINION OF CANADA.  
DEPARTMENT OF AGRICULTURE.  
EXPERIMENTAL FARMS.

J. H. GRISDALE, B. Agr.,  
Director.

FRANK T. SHUTT, M.A.,  
Dominion Chemist.

DIVISION OF CHEMISTRY.

---

## THE FARMER AS A MANUFACTURER

BY

A. T. STUART, B.A., Assistant Chemist.

---

### Part III.—Farm Products: Food and clothing materials—their formation and composition.

#### THE PROCESSES OF LIFE.

*It is in the little cells, of which all plants and animals are constructed, that the manufacture of Protein, Fat, Carbohydrates and Fibre as well as colours, odours and flavours take place. Each cell is a wonderful chemical factory.*

Under the microscope all plants and animals are found to be made up of little cells or pouches. Some consist of only one or few cells, such as brewers' yeast, while others, as for instance, a tree or a cow, are made up of thousands upon thousands. The cells of the orange and lemon are so large that they can be readily seen, when cut.

If we closely examine a cell we shall gain some idea of the structure of all that grows—both plants and animals. As an example, take a cell of the Jerusalem artichoke seen under a microscope which will magnify it 230 times. It resembles a little bag filled with water. Within the cell is a little round body, 'the nucleus.' A viscous turbid fluid, protoplasm, lines the inside of the cell-wall and is connected with the nucleus. This liquid plays a very important part in all the processes of life and from it everything else is manufactured. We thus have:

1. The wall—fibre or tissue.
2. The contents lining the wall—protoplasm.
3. Little body in centre—nucleus.
4. Clear liquid—sap.

Cotton, flax and hemp consist of long slender cells, in wood the cells are long and arranged in bundles. All living cells are distended with liquids; in plants which yield oil small droplets of oil are to be seen, while coloured and milky juices travel up and down in the specialized spaces between the cells. The size of plant cells varies from often less than  $\frac{1}{2000}$ -inch to 12 inches, as in seaweed. All growth in plants and animals results from an increase in the number of cells. The nucleus divides into two parts and walls grow around each, and thus we have two cells. In small plants like yeast, the growing cells separate, while in trees the cell walls stick together and form fibre. In the puff ball, which in a single night may grow as large as a peck measure, the cells multiply at the rate of 400,000,000 per hour.

By even a slight acquaintance with the nature of a cell one is better able to understand the principles underlying the feeding of plants and animals, and thus will be in a better position to feed his crops and stock economically. Each cell is a wonderful little factory in itself. There are no doors or windows so that all materials must come in through the cell walls. Inside the cell, the nucleus, in the case of plants, manufactures plant protein, fats and carbohydrates; and in the case of animals, animal protein, fats, but no carbohydrates.

Furthermore materials to be useful, for life, must be capable of being dissolved in water by means of various natural agents. We speak of plant food being 'available' and of animal food being 'digestible.' Food in any other condition is useless and represents mere waste.

In the case of animals the food is acted upon by the digestive juices which enable it dissolve in water. In such form the food then passes through the walls of the little blood vessels and is transported to all parts of the body to be delivered to the working and growing cells.

This brings us to a study of the products of the farm—the various forms of protein, fat, carbohydrates and fibres.

## THE PRODUCTS OF THE FARM.

### PROTEIN, FAT, CARBOHYDRATES AND FIBRES.

The products of the farm are thus classified:

- (a) Plant products.—1. For human food, direct.  
 2. For stock food, direct.  
 3. For manufacture of foods, clothing and shelter.
- (b) Animal products.—1. Human food, direct.  
 2. For manufacture of food, clothing and shelter.

### STOCK FOODS.

The following tables are of considerable interest as showing that the nature of the apparently great variety of materials is comparatively simple and can be easily understood. By reading the figures one will be able to distinguish between good and valuable products and inferior ones.

## COMPOSITION OF IMPORTANT FEEDING STUFFS.

	Waste.		Valuable.		
	Water	Indigestible.	Protein.	Digestible Carbohydrates.	Fat.
<b>Corn products—</b>					
Corn kernel .....	11	9	8	67	4.3
Corn and Cob meal .....	15	16	4	69	3
Gluten meal .....	8	12	26	43	11
Germ meal .....	10	14	9	61	6
Sugar meal .....	7	13	19	52	9
<b>Wheat products—</b>					
Wheat .....	10	9	10	69	2
Low grade flour .....	12	16	8	63	1
Wheat bran .....	12	34	12	39	3
Wheat shorts .....	12	12	12	50	4
Wheat middlings .....	12	18	13	53	3.5
Wheat screenings .....	12	25	10	51	2
<b>Rye products—</b>					
Rye .....	12	9	10	68	1
Rye bran .....	12	24	11.5	50	2
Rye shorts .....	9	32	12	45	1.5
<b>Barley products—</b>					
Barley .....	11	12	9	66	1.5
Malt sprouts .....	10	32	19	37	1.5
Brewer's grains, wet .....	76	10	4	9	1.5
"    dried .....	8	35	16	36	5
<b>Oat products—</b>					
Oats .....	11	29	9	47	4
Oat meal .....	8	22	11.5	52	6
"    feed or shorts .....	8	30	12.5	47	3
"    dist .....	6	42	9	38	5
"    hulls .....	9	50	1	40	.6
Buckwheat .....	12	29	8	49	2
<b>Oil bearing seeds—</b>					
Flax seed .....	9	24	21	17	29
Linseed meal (old process) .....	9	22	29	33	7
"    (new " ) .....	10	19	28	40	3
Cotton seed meal .....	8	26	37	17	15
"    hull .....	11	54		33	1.5
Sunflower seed .....	7	31	12	21	29
Peas .....	10	20	17	52	1
Green fodder corn .....	80	5.5	1	12	4
Fodder corn (field cured) .....	58	3.5	2.5	35	1
<b>The Grasses: pasture and soiling—</b>					
<b>Grasses—</b>					
Pasture grass (mixed) .....	80	7	2.5	10	5
Timothy .....	62	17	1.2	19	6
Red top, in bloom .....	65	11	2.1	21	6
Oat fodder .....	62	15.5	2.6	19	1
<b>Hay—</b>					
Timothy .....	13	40	2.8	43	1.4
Red top .....	9	38	4.8	47	1
Mixed grasses .....	13	39	6	41	1.2
<b>Straw—</b>					
Wheat .....	10	53	4	36	4
Oat .....	9	50	1.2	39	8
<b>Green forage (legumes)—</b>					
Red clover .....	70	11	3	15	7
Alfalfa .....	70	12	4	13	5
Cow pea .....	85	4	2	9	2
Soya bean .....	75	10	3.2	11	5
<b>Hay and Straw (legumes)—</b>					
Red clover .....	15	40	7	36	1.7
Alfalfa .....	9	39	11	40	1.2
Cow pea .....	11	54	11	39	1.1
Soya bean (straw) .....	11	46	2.3	40	1
<b>Roots and tubers—</b>					
Potatoes .....	80	3	1	16	.1
Sugar beets .....	87	2	1.1	19	.1
Mangels .....	90	3.5	1.1	5.4	.1
Turnips .....	90	1.5	1.1	7.2	.2
Rape .....	85	5.5	1.5	8	.2
<b>Manufactured products—</b>					
Dried blood .....	9	36.5	52		2.5
Meat scrap .....	11	9	66		14
Beet pulp .....	90	2.5	6	7	
"    molasses .....	20	11	9	60	



The food requirements of an animal, both as to quantity and quality, are determined by its age and function. A young and growing animal needs a liberal ration rich in protein and bone-forming material; a mature animal doing no work can do very well on a ration comparatively poor in protein. Economy in feeding is attained by meeting the requirement of special cases—cows in milk, steer fattening, laying hens, &c.

The value of food (protein, fat and carbohydrates) can be measured by the amount of energy it is able to develop for supplying the body with warmth and strength. The measure used is called a calory. In the following table the composition and 'fuel value' of the more common human foods are given, together with the figures showing the relative costs to the consumer.

## HUMAN FOODS.

	Ir. digestible refuse.	Water.	Protein.	Fat.	Carbo-hydrates.	Ash.	Calories (fuel value) per pound.	
	%	%	%	%	%	%		
Beef, fresh								
Sirloin steak	12.8	54.0	16.5	16.1		0.9	975	
Loin	13.3	52.5	16.1	17.5		0.9	1,025	
Shank	36.9	42.9	12.8	7.3		0.6	545	
Corned beef	8.4	49.2	14.3	23.8		4.6	1,245	
Tongue, pickled	6.0	58.9	11.9	19.2		4.3	1,010	
Veal, leg	14.2	60.1	15.5	7.9		0.9	625	
Mutton, hind leg	18.4	51.2	15.1	14.7		0.8	890	
Lamb, hind leg	17.4	52.9	15.9	13.6		0.9	860	
Pork, fresh ham	10.7	48.0	13.5	25.9		0.8	1,320	
Pork, smoked ham	13.6	34.8	14.2	33.4		4.2	1,635	
Sausage, pork		39.8	13.0	44.2	1.1	2.2	2,075	
Eggs, hen's	11.2	65.5	13.1	9.3		0.9	635	
Butter		11.1	1.0	85.0		3.0	3,410	
Milk, whole		87.0	3.3	4.0	5.0	0.7	310	
Cream		74.0	2.5	18.5	4.6	0.5	865	
Cheese, full cream		34.2	25.9	33.7	2.4	3.8	1,885	
Flour		12.0	11.4	1.0	75.1	0.5	1,635	
Bread, white		35.3	9.2	1.3	53.1	1.1	1,200	
Soda crackers		5.9	9.8	9.1	73.1	2.1	1,875	
Molasses					70.0		1,225	
Candy					96.0		1,680	
Sugar					100.0		1,750	
Beans, dried		12.6	22.5	1.8	59.6	3.5	1,520	
Cabbage		15.0	77.7	0.9	0.2	4.8	0.9	115
Onions		20.0	78.9	1.4	0.3	8.9	0.5	190
Potatoes		20.0	62.6	1.8	0.1	14.7	0.8	295
Apples		25.0	63.3	0.3	0.3	10.8	0.3	190
Oranges		27.0	63.4	0.6	0.1	8.5	0.4	230
Watermelons		59.4	37.5	0.2	0.1	2.7	0.1	50
Raisins		10.0	13.1	2.3	3.0	68.5	3.1	1,265
Peanuts		24.5	6.9	19.5	29.1	18.5	1.775	
Chocolate		5.9	12.9	48.7	30.3	2.2	5,625	

## Ten cents will purchase—

Beef, sirloin.....	540	calories. (Energy, heat, etc).
Beef, stew meat.....	1,530	"
Mutton chops.....	890	"
Roast pork, loin.....	1,035	"
Pork, fat, salt.....	2,950	"
Halibut, fresh.....	295	"
Salmon, canned.....	760	"
Oysters.....	100	"
Butter.....	1,125	"
Eggs.....	385	"
Cheese.....	1,195	"
Milk.....	885	"
Wheat flour.....	6,000	"
Corn meal.....	6,540	"
Oatmeal.....	4,500	"
Rice.....	2,025	"
Wheat bread.....	2,400	"
Beans, white, dry.....	3,040	"
Celery.....	130	"
Potatoes (90c. bush).....	1,970	"
Turnips.....	1,200	"
Apples.....	1,270	"
Bananas.....	370	"
Sugar.....	2,920	"

The most expensive food in list.

The cheapest food in list.

## FACTORY PRODUCTS.

The farmer manufactures from air, water and soil all the varieties of food and clothing—protein, fat, carbohydrates, tissues and fibres, colours, odours, flavours, digestives, poisons, alkaloids, etc. The so-called manufacturer merely sorts these out by machinery and chemical processes and sells or uses them for various purposes. Who is the real manufacturer?

In the first column of the following table we have the constituents of plants and animals produced on the farm; in the second column there is the disposition of those from plant sources, in the third that of the products from animals.

Farm Products.	Factory Products.	
	(a) Plant.	(b) Animal.
I. Protein.....		Meats, casein, glue, etc. etc.
II. Fats.....	Oils..... Linseed oil, corn oil, cotton seed oil, etc., for paints, soap, lubricants.	Oleo oil, lard oil, etc., for soaps, lubricants, etc.
	Fats..... Stearin.....	Lard, tallow, greases, etc.
	Wax..... Carnauba.....	Beeswax.
	Gums..... Rubber, chewing gum.....	
III. Carbohydrates.....	Sugar, candy, starch, beer, whiskey, pastes, etc.	None.
IV. Mineral.....		Bone products.
V. Tissues and Fibres.....	Cotton, linen, wood and paper....	Wool, hair, leather, silk.
VI. Colours, odours, flavours, digestives, alkaloids, poisons and all plant extracts.		



