A NOTE-BOOK OF AGRICULTURAL FACTS AND FIGURES.

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A NOTE-BOOK

OF

AGRICULTURAL FACTS AND FIGURES

COMPILED BY

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THIRD EDITION.

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PREFACE TO THIRD EDITION.

THE few years since this book was first published in 1915, have seen a considerable increase in the interest taken by the man in the street in Agriculture and the production of grain, and the increased demand for the present publication has necessitated a third edition. Opportunity has been taken to revise and correct it where possible, but the work has had to be done intermittently and in my scanty leisure, and I trust its users will pardon the many mistakes. I have not altered the figures for costing : all values are shifting relatively and actually, and I have thought it better to stick to the pre-war figures, which at any rate represent a fairly well-defined standard.

I am responsible for the arrangement of the matter, but I need hardly say that without the generous assistance of my colleagues on the staff of this department the book could not have been compiled. I desire to express my thanks to Mr. Cecil Fischer, of the Indian Forest Service, for the notes on the timber trees of the Presidency. I wish also to express my thanks to the Government of Madras, for the generous way in which they have recognized my efforts.

MADRAS,
January 1920.

R. CECIL WOOD.

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A NOTE-BOOK

OF

AGRICULTURAL FACTS AND FIGURES.

WEIGHTS AND MEASURES.

Imperial Avoirdupois Weight.

27·34 grains (gr.)	... ...	= 1 drachm (dr.)
16 drachms	... ...	= 1 ounce (oz.).
16 ounces (7,000 grains)	...	= 1 pound (lb.).
14 pounds	... ...	= 1 stone (st.).
28 pounds	... ...	= 1 quarter (qr.).
4 quarters	... ...	= 1 hundredweight (cwt.).
112 pounds	... ...	= 1 hundredweight.
20 hundredweights	... ...	= 1 ton.

Imperial Indian Weight.

(*Used in Railways.*)

10 tolas	... ...	= 1 chittak.
8 chittaks	... ...	= 1 seer.
40 seers	... ...	= 1 maund.

A tola is the weight of a rupee and is ·414 oz. or 180 grains. One seer weighs 2·057 lb. Avoirdupois, and one maund 82·28 lb.

Madras Weight.

3 tolas ...	... ...	= 1 palam.
8 palams	... ...	= 1 seer.
5 seers	... ...	= 1 viss.
8 visses	... ...	= 1 maund.
20 maunds	... ...	= 1 candy.

A viss is 3·0857 lb. A Madras maund is thus nearly 25 lb. Avoirdupois (24·68), and a candy is generally taken at 500 lb. 1 lb. = 38·88 tolas.

The table used by European merchants in Madras is slightly different from the above and is as follows :—

1 palam	... ...	= 1¼ oz. avoirdupois.
40 palams	... ...	= 1 viss = 3⅛ lb.
8 visses	... ...	= 1 maund = 25 lb.
20 maunds	... ...	= 1 candy or baram = 500 lb.

Imperial Measures of Capacity.

5 fluid ounces of water	...	= 1 gill.
4 gills	...	= 1 pint (pt.).
2 pints ...	...	= 1 quart (qt.).
4 quarts	...	= 1 gallon (gal.).
2 gallons	...	= 1 peck (pk.).
4 pecks	...	= 1 bushel (bus.).
8 bushels	...	= 1 quarter (qr.).

A gallon contains 277·463 c. inches and equals 10 lb. of distilled water at 62° F.

6·25 gallons	...	= 1 cubic foot.
1 gallon	...	= ·16 cubic foot.

1 fluid ounce pure water weighs 1 oz. avoirdupois.

"A pint of pure water weighs a pound and a quarter."

Madras Measures of Capacity.

These are extremely variable, and only a few of the most widely known are given.

8 ollocks	...	= 1 Madras measure (M.M.), pucka or padi.
8 Madras measures	...	= 1 marakkal.
1 marakkal = ½ cub. foot ...		= 500 fluid oz.

The type Madras measure is 108 inches cubic capacity, contains 62·5 fluid ounces and is usually 4·5 inches in diameter and 6·75 inches deep.

In Madras and Saidapet it is struck : elsewhere it is heaped.

The seer when used as a measure is about 80 tolas : but varies with the commodity that is being used.

Imperial Linear Measure.

3 barleycorns	... ...	= 1 inch (in.).
12 inches ...	... ...	= 1 foot (ft.).

LOCAL WEIGHTS AND MEASURES.

ANANTAPUR.

Table of Weights.

21	tolas (or ·4114 of an oz.)	= 1 seer.
1½	seers	= 1 sava seer.
2	sava seers	= 1 adi seer (3 seers).
2	adi seers	= 1 panch seer (6 seers).
12	seers	= 1 dhadiyam.
4	dhadiyams	= 1 maund (25·92 lb.).
	ara seer	= ½ seer.
	pavu	= ¼ seer.
	ara pavu	= ⅛ seer.
	chattak	= $\frac{1}{16}$ seer.

A seer of gold or silver weighs, as elsewhere, 24 tolas.

Grain Measure.

1 seer = 88 tolas weight of second sort rice heaped, divided into ara, pavu, etc., as before.

The next largest measure above the seer is the muntha whose capacity differs from taluk to taluk.

16	munthas	= 1 thumu.
20	thumus	= 1 putti.

The thumu and the putti are as inconstant in value as the muntha itself.

Liquid Measure.

The grain seer is used for milk, buttermilk and curd. Oil and ghee are generally sold by weight.

BELLARY.

Weights.

Same as Anantapur.

Grain Measures.

1 seer = 84 tolas weight of a mixture of the 9 grains known as navadhanya,

which seems = 86 tolas weight of paddy divided into ara, pavu, etc.

The multiples of this seer differ in different taluks: in Bellary taluk a putti weighs 2,560 seers.

Liquid Measures.

Same as Anantapur.

CHINGLEPUT.

1 gundu of firewood ... = 56 lb.
8 ollocks ... ... = 1 M.M.
4 M.M. ... ... = 1 Tiruvellur jodu.

COIMBATORE.

8 rupees wt. ... ... = 1 palam.
15 palams ... ... = 1 viss.
8 visses ... ... = 1 maund.
10 maunds ... ... = 1 pothy.
20 maunds ... ... = 1 baram.
12 tulams ... ... = 1 pothy.

A palam of 3 rupees is used for drugs.

2 M. M. ... ... = 1 vallam.
33 vallams ... ... = 1 selagai.

There are a number of local measures which are gradually being replaced by the standard M.M.

The Coimbatore vallam is larger than the standard one and 30 only go to the selagai.

1 maund of jaggery ... = 26 lb.

When firewood is sold by the ton, the maund is often taken at 28 lb., i e., 80th of a ton.

CUDDAPAH.

32 M.M. ... ... = 1 thumu.
20 thumus ... ... = 1 putti.

GANJAM.

Weights.

80 tolas... ... ... = 1 seer.
5 seers ... ... = 1 viss.
8 visses ... ... = 1 maund.
8 maunds ... ... = 1 candy.

For gingelly, castor, coconut-oil and ghee, 1 seer = 22 tolas.

For onions, garlic, saffron, tamarind, potatos and silk, 1 seer = 24 tolas.

For chillies ... ... 1 seer = 105 tolas.
For vegetables, etc. ... 1 seer = 180 tolas.
For camphor, spices ... 1 viss = 118 tolas.

Land Measure.

4 seers of rice and other grains = 1 thumu.
16 seers ... ... = 1 nowtie (cent).
20 nowties ... ... = 1 bharanam.
100 nowties ... ... = 1 acre.

GODAVARI.

Weights.

2 pampus ... ... = 1 yebulam.
2 yebulams ... ... = 1 padalam.
2 padalams ... ... = 1 viss (5 seers or 120 tolas).
2 visses ... ... = 1 yettedu.
4 yettedus ... ... = 1 maund (or 25 lb.).
20 maunds ... ... = 1 putti (or candy).

Fuel is sold by the following table :—

5 maunds ... ... = 1 kavadi.
4 kavadis ... ... = 1 putti.
1 putti dry jungle wood ... = 500 lb.
1 putti green jungle wood ... = 612 lb.
1 putti of jaggery ... ... = 504 lb.

Grain Measures.

5 tolas weight of rice ... = 1 gidda.
4 giddas ... ... = 1 sola.
2 solas ... ... = 1 manika or seer (holds 80 tolas weight of rice).
2 manikas ... ... = 1 adda.
2 addas ... ... = 1 kuncham (320 tolas weight of rice).
20 kunchams ... ... = 1 yedumu or kavadi.
2 yedumus ... ... = 1 pandumu.
2 pandumus ... ... = 1 palle putti (80 kunchams).

7½ palle puttis	=	1 garce (garisa of 600 kunchams or 192,000 tolas weight of rice).
1 bag or busta of paddy ...	=	166 lb.

Linear Measurement.

1 nulu	=	⅛ inch.
2 nulu	=	1 pathika.

Land Measure (popular).

1 kuncham	=	10 cents.
1 yedum	=	2 acres.
1 pandum	=	4 acres.

MALABAR.

Walluvanad Taluk.

Measurement for Grain and Liquids.

2 azhakus	=	1 ozhaku.
2 ozhakus	=	1 uri.
2 uris	=	1 nazhi.
4 nazhis	=	1 edangali.
6 nazhis	=	1 narayam.
10 narayams	=	1 para.
24 nazhis	=	1 chottana.

NOTE.—One Madras measure = 7 nazhis; 1 narayam paddy weighs 90 rupees weight.

Linear Measurements.

8 ellummanies	=	1 thora.
8 thoras	=	1 viral.
24 virals	=	1 muzhakole or carpenter's kole.
2,000 muzhakoles	=	1 nazhika.
4 nazhikas	=	1 kathom.

Measurements by Timber Merchants.

576 perukams	=	1 candy.

Weights.

4 nellummanies	= 1 kunni.
2 kunnis	= 1 manjadi.
2 manjadis	= 1 panathookam.
10 panathookams	= 1 kazhanchu.
12 kazhanchus	= 1 palam.
100 palams	= 1 thulam.
20 thulams	= 1 bharam.

Note.—Grain is measured struck. There are palams of different weights.

Bazaar drugs, 1 palam	= 5 rupees weight.
Jaggery and tobacco, 1 palam ...	= 10 ,,
Pepper, ginger, sweet potatos, etc., 1 palam	... = 15 ,,

Ernad Taluk.

5 Walluvanad nazhis	= 1 edangali.
10 edangalis	= 1 para.
1 kole of sawed timber	= ½ kole × 1 viral × 1 viral.
1 kole	= 2 ft. $3\frac{3}{10}$ in.

Note.—24 local virals make 1 kole.

Ginger is sold by the thulam of 35 lb. weight.

Chirakkal Taluk.

Measurements for Grains.

4 nazhis	= 1 edangali or seer.
1 edangali	= 1 Madras measure very nearly.
10 edangalis or seers	= 1 para.
3 nazhis	= 1 kongayi.
In the hills, 1 mada	= 25 seers.

Note.—All are heaped measures.

Liquid Measures.

6 small nazhis	= 1 kutti.
1 kutti	= 4 quart or big bottles.

Weights.

1 palam ... ... = 9 rupees weight.
40 rupees weight ... ... = 1 lb.
28 lb. ... ... = 1 thulam.
20 thulams ... ... = 1 bharam.

Tellicherry.

32 lb. ... ... = 1 thulam.
20 thulams ... ... = 1 bharam.

Cannanore.

30 lb. ... ... = 1 thulam.
20 thulams ... ... = 1 bharam.

Note.—In all the above three cases 1 lb. = 40 rupees weight.

MADURA.

Weights.

6 tolas (·4114 oz.) ... ... = 1 palam (nearly 2½ oz.).
20 palams ... ... = 1 viss.
6 visses ... ... = 1 thulam (about 18½ lb.).
8 visses ... ... = 1 maund (about 25 lb.).

Grain Measure.

1 heaped measure contains = 132 tolas rice.
4 measures ... ... = 1 marakkal.
12 marakkals ... ... = 1 kalam.

NILGIRIS.

Land Measure.

28 adis or country feet ... = 1 kole = 24 English ft.
1 square kole ... ... = 1 guli = 576 sq.ft.
100 gulis ... ... = 1 cawny = 57,600 sq.ft. or 1·322 acres.
1 balla ... ... = 3·82 acres = 166,464 sq.ft.
60 × 40 feet or 2,400 sq.ft. = 1 manai or house-site.

Measures.

2 ollocks ... ... = 1 ullock.
8 ollocks ... ... = 1 padi or measure.

8 measures	...	...	...	= 1 marakkal.
5 marakkals	...	...	...	= 1 para.
400 marakkals	...	...	...	= 1 garisa.
50 jodis (i.e., double measures or 100 Madras measures).				= 1 palla.

WEIGHTS.

3 rupees weight (tolas)			...	= 1 palam.
8 palams	...	...	...	= 1 seer.
5 seers (3⅛ rattal)		...	...	= 1 viss.
50 palams (1¼ viss)		...	...	= 1 tuk.
8 visses	...	...	...	= 1 maund.
20 maunds	...	...	...	= 1 bharam or candy.

SALEM.

MEASURES.

2½ M.M.	...	...	...	= 1 vallam.
40 vallams	...	...	...	= 1 kandagam.

The vallam varies up to 3 M.M.

WEIGHTS.

The tuku is used, but varies from 1¼ viss to 2½ viss according to the commodity.

2½ tukus	...	...	...	= 1 thulam.
16 thulams		...	...	= 1 sattai.
In Namakkal, 16 vallams.				= 1 moda.
6 modas	...	...	...	= 1 podi.

NORTH ARCOT.

WEIGHTS.

3 tolas	...	...	...	= 1 palam.
8 palams	...	...	...	= 1 seer (kaccha).
5 seers	...	...	...	= 1 viss.
2 visses	...	...	...	= 1 dhadiyam.
4 dhadiyams		...	...	= 1 maund.
20 maunds	...	...	...	= 1 candy.

The *pucka* seer of Chittoor and Vellore is 72 tolas.

Measures.

8 padis	... ...	= 1 marakkal or toom.
12 marakkals	... ...	= 1 kalam.
400 marakkals	... ...	= 1 garce.
40 kalams	... ...	= 1 candy.

The toom or marakkal differs in different places of the district.

Milk, curds and buttermilk are sold by measure.

Ghee, oils and honey are sold by measure as well as by weight.

Land Measure.

1 kole or rod	... ...	= 24 feet.
1 square kole	... ...	= 576 square feet = 1 kuzhi (Tamil) or gunta (Telugu).
100 kuzhis or guntas	...	= 1 kani = 57,600 square feet = 1·32 acres. Same as cawny of Tanjore.

SOUTH ARCOT.

Weights.

3 tolas	... ...	= 1 palam.
8 palams	... ...	= 1 seer.
40 palams (5 seers)	...	= 1 viss.
50 palams	... ...	= 1 tuk.

12 palams and a fraction (varying in different localities) = 1 rattal (for indigo).

The 'French' pound is ·5 kilo. The groundnut candy is 240 kilos = 529·2 lb.

In the Salt Factories.

80 tolas	... .	= 1 seer.
40 seers	... ...	= 1 Indian maund.
120 maunds	... ...	= 1 garce (4·39 tons).

Grain Measure.

(Officially recognized.)

132 tolas of rice	... ...	= 1 heaped Madras measure.
2 Madras measures	... ...	= 1 marakkal.

The marakkal however varies in size in different taluks though at all places 12 marakkals = 1 kalam and 24 kalams are generally held equal to a cartload. Near Palur, a kalam = 36 Madras measures and 12 kalams go to the cartload.

Liquid Measure.

Usually as fractions and multiples of a Madras measure, ghee and oil are retailed by weight by the seer and palam above.

Arrack is sold by gallons and drams.

Linear Measure.

9 angulas (thumb's breadths)	= 1	jan (span).
12 "	= 1	adi (foot).
18 "	= 1	molam (cubit, length from elbow to tip of middle finger).
2 molams	= 1	gaja (yard).
2 gajas	= 1	mar (distance between tips of the two middle fingers measured across the chest with the arms horizontal).

Land Measure.

24 feet	= 1	kole (rod).
1 square kole (576 sq.ft.).	= 1	kuli.
100 kulis	= 1	kani (1·32 acres).

SOUTH KANARA.

Mangalore.

Weights.

24 tolas	= 1	seer.
48 seers	= 1	maund.
20 maunds	= 1	candy.

Grain Measures.

1 pavu	...	...	...	= ¼ seer.
2 pavus	...	...	...	= ½ seer.
14 seers	...	...	...	= 1 kalasikay.
3 kalasikays	...	...	...	= 1 muda.
42 mudas	...	...	...	= 1 korgee.

Note.—One muda paddy seed is generally 4 kalasikays.

Liquid Measures.

1 kututhay	...	...	...	= 12 rupees weight.
9 kututhays	...	...	...	= 1 kutti.
2 kututhays	...	...	...	= 1 seer.
10 kuttis	...	...	...	= 1 maund.

Udipi—Liquids.

12 kudukthas ... ... = 1 baylay.

Coondapoor.

1 sidhay	...	...	...	= 1¼ kututhay.
1 manikay	...	...	...	= 1 muda.

Bantwal side, Mangalore Taluk.

7 kuttis	...	...	...	= 1 samma mana or maund.
10 kuttis	...	...	...	= 1 thodda mana or maund.
4 doddays	...	...	...	= 1 maund.

Money and Gold.

1 varah	...	...	...	= 4 rupees.
1 duddu	...	...	...	= 4 pies.
1 pie	...	...	...	= 2 chikas.
12 duddus	...	...	...	= 1 chakra = 4 annas.
2 chakras	...	...	...	= 1 chavala = ½ rupee.

TANJORE AND TRICHINOPOLY.

Weights.

16 pies	= 1	palam or 3 tolas.
8 palams	= 1	seer.
5 seers	= 1	viss.
8 visses	= 1	maund.
20 maunds	= 1	candy.

Hides and leather are weighed in terms of a *rattal* of $1\frac{1}{2}$ seers.

Vegetables, tamarind, etc., in terms of thukku or edai of $6\frac{1}{4}$ seers.

Measures.

2 padis	= 1	marakkal.
12 marakkals	= 1	kalam.
2 kalams	= 1	somai (load).
5 somais	= 1	urai.
4 urais	= 1	bandy load.
120 coconuts	= 1	somai or load.
40 marakkals of onions ...	= 1	podi or pack.
32 palams of oil (vegetable) ...	= 1	sombu.
16 sombus	= 1	adam.

A small padi, of which four go to the marakkal, is still largely used by the ryot. A seer, one-fifth of a padi, is used for measuring milk, etc The kalam itself varies from taluk to taluk.

Land Measure.

144 sq. feet.	= 1	kuli.
100 kulis	= 1	ma.
3 ma's	= 1	acre
4 ma's	= 1	kani.
20 ma's	= 1	veli ($6\frac{74}{121}$ acres).

TINNEVELLY.

Weights.

$5\frac{32}{64}$ rupees weight	= 1	palam.
144 palams	= 1	tulam (100 palams = 1 tulam in the south).
12 tulams	= 1	pothi.
2 pothis	= 1	candy (500 lb.).

1 tulam	... ...	= 20¾ lb.
16 tulams	... ...	= 1 podi in Rāmnād district.
12 tulams	... ...	= 1 podi of seed.
16 tulams	... ...	= 1 podi of Kappas—in cotton tracts north of Sattur.
72 palams	... .	= 1 edai in cotton tract.
25 palams	... ...	= 1 edai in the south.
20 palams	... ...	= 1 edai in Srīvilliputtūr taluk of Rāmnād district.
4¼ palams	... ...	= 1 seer (Rs. 25 weight).

In the cotton tracts in the south 1 edai is equivalent to 10¼ lb.

Weights used for weighing Gold and Silver.

20 manchadis	... ...	= 1 kalanji.
4/5 kalanji	... ...	= 1 varagan idai.
3 5/8 varagan idai	.. ..	= 1 rupee weight = 1 tola.

Grain Measures.

2 half mahanis	... ...	= 1 mahani (1/16 measure).
2 mahanis	... ...	= 1 ollock (1/8 Madras measure).
2 ollocks ...	... ...	= 1 ullock (1/4 Madras measure).
2 ullocks ..	... ...	= ½ Madras measure.
4 ullocks ...	... ...	= 1 nali (1 Madras measure).
1½ seers	... .	= 1 Madras measure.
96 Madras measures		= 1 kottai (Koilpatti tract).
112 Madras measures	... ...	= 1 do. (in Tinnevelly).
120 Madras measures	... .	= 1 do. (Rāmnād district).
4 Madras measures	... ...	= 1 marakkal.
48 Madras measures	... ...	= 1 kalam.

In some parts of Rāmnād—

3 Madras measures	... ...	= 1 marakkal.
90 Madras measures	... ...	= 1 kottai.

Land Measurement.

Wet Land.

8 seer padi ... ... = 1 marakkal (nearly 8 cents).
21 marakkals ... ... = 1 kota (163 cents).

Dry Land.

21 kurukkams is the area which can be ploughed by one pair in a day.
8 kurukkams ... ... = 1 sangili

or—

3 Madras measures ... ... = 1 marakkal.
30 marakkals ... ... = 1 kottai.
12 marakkals ... ... = 1 acre.

VIZAGAPATAM.

Weights.

2 chatakas	... = 1	nantak ...	=	1¼ oz.
8 nantaks	... = 1	seer	=	10 oz.
5 seers	... = 1	visam or viss	=	3⅛ lb.
8 visams	... = 1	manugu or maund	=	25 lb.
8 manugus	... = 1	kantlam ...	=	200 lb.
20 manugus	... = 1	putti or candy	=	500 lb.

The following table is also used side by side with the first :—

2 yebalams	... = 1	padalam ...	=	1½ lb.
2 padalams	... = 1	visam	=	3 lb.
8 visams	... = 1	manugu ...	=	24 lb.
8 manugus	... = 1	kantlam	=	192 lb.
20 manugus	... = 1	candy	=	480 lb.

Grain and Liquid Measure.

4 giddas	... = 1	sola	=	...
2 solas	... = 1	tavva	=	2⅛ pints.
2 tavvas	... = 1	adda or manika.	=	4¼ pints.
4 addas	... = 1	kuncham ...	=	17 pints.
20 kunchams	... = 1	buri putti (in Kondakerla firka).		
80 kunchams	... = 1	pedde putti (in rest of taluk).		
600 kunchams	... = 1	garisu (garce).		

OTHER WEIGHTS AND MEASURES.

Cotton.

1 skein	= 120 yards.
7 skeins	= 1 hank.
18 hanks	= 1 spindle.
The number of hanks to 1 lb. ...	= "counts."

Angular Measure.

60 seconds (″)	= 1 minute (′).
60 minutes	= 1 degree (°).
90 degrees	= 1 right angle.

Metrical System.

Linear Measure.

10 millimetres	= 1 centimetre.
10 centimetres	= 1 decimetre.
10 decimetres	= 1 metre.
10 metres	= 1 decametre.
10 decametres	= 1 hectometre.
10 hectometres	= 1 kilometre.
10 kilometres	= 1 myriametre.
1 millimetre	= ·039370 inch.
1 metre	= 3·28084 feet.
1 kilometre	= ·62137 mile.

Square Measure.

1 hectare = 1 square hectometre = 2·4711 acres.

Weights.

1 gramme	= ·03527 oz. (Avoirdupois).
1 kilogramme	= 2·20146 lb. (Avoirdupois).

Dry Fluid Measure.

1 litre ... ... = ·21998 gallons.

The metrical system is based on the *metre* which is the ten millionth part of the quadrant of a terrestrial meridian. The *litre* is the cube of the tenth part of the *metre*, and the weight of a *litre* of distilled water at its greatest density is a ***kilogramme***.

Useful Numbers.

For converting.	Multiply by	Converse.
Linear.		
Feet into links	1·5151	·66
Yards „ „	4·545	·22
Chains „ miles	·0125	80
Feet „ metres	·3048	3·2809
Yards „ „	·9144	1·0936
Chains „ „	20·117	·049
Square.		
Square yds. into sq. metres ...	·8361	1·196
Square „ „ acres	·0002066	4,840
Square miles „ „	640	·001562
Capacity.		
Cubic ins. into bushels	·00045	2219·7
Cubic ft. „ „	·778	1·285
Cubic „ „ gallons	6·228	·1605
Cubic „ „ Madras Measures ..	16·0	·0625
Gallons „ litres	4·543	·220
Litres „ cub. ft.	·03532	28·33
Weights.		
Lb. into cub. ins. of water ...	27·74	·036
Lb. „ „ ft. „ ...	·01605	62·2786
Cubic ft. of water in tons	·0278	35·9
Lb. into kilogrammes	·4536	2·2
Money.		
Dollars into Rs.	3·1245	·32
Francs „ „	·58665	1·70

MENSURATION AND SURVEYING.

Area of rectangle = length × breadth.

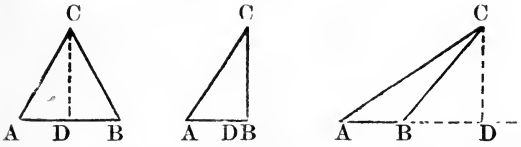
Area of square = any side × itself.

Area of parallelogram = base × perpendicular height.

Area of trapezoid = half the sum of the parallel sides × perpendicular height.

Area of trapezium or any quadrilateral = sum of the two triangles of which it is composed.

Area of triangle = half the product of the base into the perpendicular height or $\frac{AB \times CD}{2}$.



or if s = half the sum of the three sides a, b, c, the area = $\sqrt{s\,(s-a)\,(s-b)\,(s-c)}$

(a) Area of a circle = diameter^2 × ·7854.

To multiply by ·7854, multiply by 7 and then by 2 moving the rows one place to the right, as shown below :—

865
7

6055	...	...	7
6055	...	...	7
12110	...	...	14
12110	...	...	14
679·3710	...	...	7854

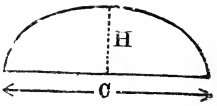
The circumference = twice the radius × $\frac{22}{7}$ or the diameter × $\frac{22}{7}$

(b) Area = circumference × half the radius or if r = the radius, area = $2\,r \times \frac{22}{7} \times \frac{r}{2} = \frac{22}{7} r^2$

(c) Area = (the circumference)^2 × ·08

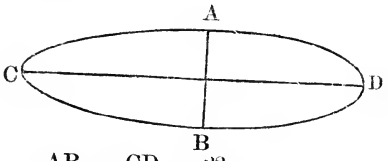
Area of a sector of a circle = length of the arc × half the radius.

Area of a segment of a circle—



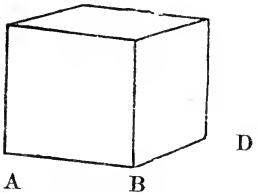
$$\text{Area} = \frac{4\,H}{3}\sqrt{\tfrac{1}{4}c \times \frac{2H^2}{5}}$$

Area of an ellipse—



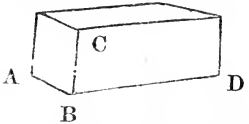
$$\text{Area} = \frac{AB}{2} \times \frac{CD}{2} \times \frac{22}{7}$$

Cube—



Surface $= 6\,(AB)^2$ or $6\,(BD)^2$
Volume $= (AB)^3$ or $(BD)^3$

Rectangular solid or parallelopiped -



Surface $= 2\,AB \times BC + 2\,BD \times BC + 2\,AB,\,BD.$
Volume $= AB \times BD \times BC.$

Solid cylinder—
Surface = area of both ends + length × circumference.
Volume = area of one end × length.

Solid cone or pyramid—

Surface of cone = area of base + circumference × ½ the slant height.

Surface of pyramid = area of the base + areas of the side triangles.

Solid content = area of the base × one-third of the perpendicular height.

Sphere—

Surface = diameter^2 × 3·14159

Solid content = diameter^3 × ·5236

Wedge—

Solid content = area of base × ½ perpendicular height if all the edges are equal.

A *Prismoid* is a solid whose ends are parallel but unequal in area, e.g., a bund whose extreme heights are unequal, a cutting whose extreme depths are different, a gravel heap on the roadside, a pond, etc.

NOTE.—A prismoid includes a cone and a pyramid: but if the ends besides being parallel are also equal and similar so that the solid is uniform from end to end it is a prism.

Solid contents of a prism = area of one of the parallel ends × height or depth or length.

The solid contents of a prismoid may be calculated in three ways—

(*a*) Average of extreme areas × length (or height).

(*b*) The middle area × length (or height).

(*c*) By the following formula :—

h = distance between the parallel ends.

A_1 = area of one end.

A_2 = area of the other and parallel end.

A_m = area of a section taken midway between A_1 and A_2 and parallel to them.

Solid contents $\frac{h}{6} \times (A_1 + 4\,A_m + A_2)$

(*a*) Always gives more than the real volume and may be used for making estimates, so as to be on the safe side.

(*b*) Always gives less than the real volume and is used for measuring heaps of road metal stored by contractor.

Example.—A metal heap has a rectangular base 14′ × 6′ and a rectangular top surface 10′ × 2′ with a height of 2′. Find its volume.

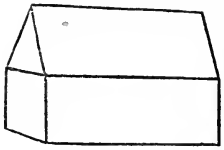
(*a*) $\frac{84 + 20}{2} \times 2 = 104$ cubic feet.

(*b*) $12 \times 4 \times 2 = 96$ cubic feet.

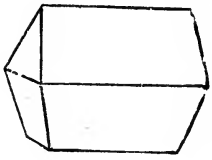
(*c*) $\frac{84 + 4 \times 48 + 20}{6} \times 2 = 98{\cdot}6$ cubic feet.

Contents of a stack.—There are two general types of stacks.

(i)



(ii)



(i) A rectangular parallelopiped and a prismoid.
(ii) Two prismoids.

The weight of straw per cubic yard in the stack varies with the nature of the straw and the length of time it has been in the stack, and the position from which it is taken. Old straw is heavier than new straw and if taken from the bottom of the stack weighs more than that from the top.

Weight of straw and examples.—The weight of cholam and paddy straw in the stack is about 124 lb. per cubic yard. The weight of a stack of hay made at Coimbatore was only 88 lb. per cubic yard.

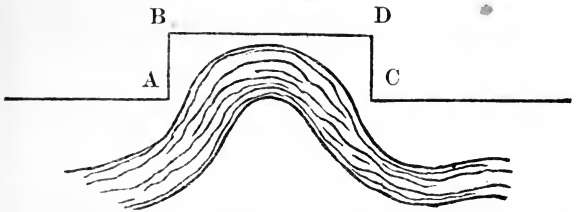
At these rates the hay will measure 25 cubic yards to the ton, and the straw, 18 yards.

To set out a right angle with the chain.

Take 40 links on the chain, 30 links for the perpendicular and 50 for the hypotenuse.

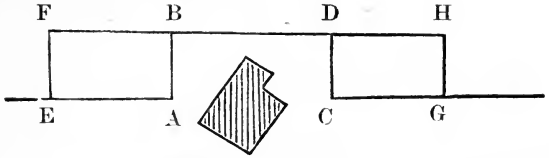
Obstacles in ranging survey lines.

1. Seen over and chained round.



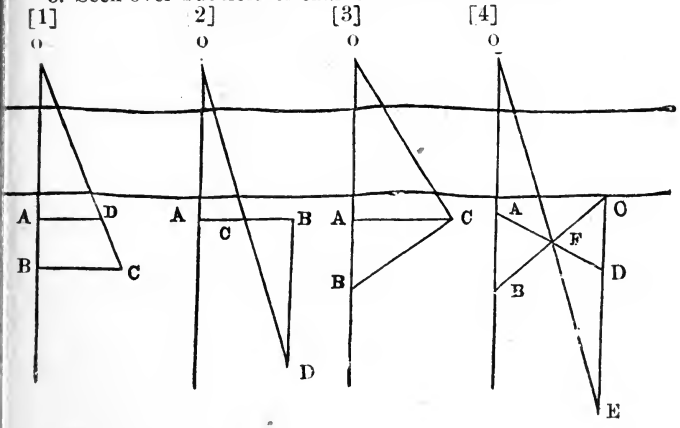
Lay off AB and CD equal to each other and at right angles to the line, then AC = BD.

2. Not seen over but chained round.



Lay off the lines EF, AB, equal to each other, and at right angles to the line ; range the points D, H, in line with FB, and set off the lines DC, HG, equal to AB and EF, and at right angles to the line FH, then C and G are points for ranging the continuation of the line EA, and AC = BD.

3. Seen over but neither chained across nor round.



By figure 1—

Measure off perpendiculars BC, AD ranging D in line with OC.

$\frac{OA}{AD} = \frac{OB}{BC}$; $OA \times BC = AD \times (OA + AB) = AD \times OA + AD \times AB$; $\therefore OA\,(BC - AD) = AD \times AB$ or $OA = \frac{AD \times AB}{BC - AD}$.

By figure 2—

Measure AB at right angles to AO and bisect AB at C. Set off BD at right angles to AB until at D, C hides O.

Then AO = BD.

By figure 3—

Set off AC at right angles to AD and CB at right angles to CO.

Then $OA \times AB = AC^2$.

Therefore $OA = \frac{AC^2}{AB}$.

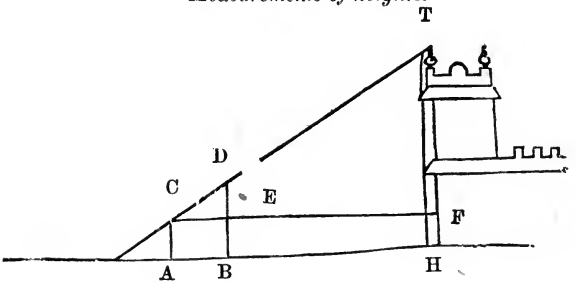
By figure 4—

Fix any line AD and bisect it at F.

Make BF = FC. Produce CD until at E, F hides O.

Then AO = DE.

Measurements of heights.



Fix two rods AC, BD, of unequal height vertically as shown so that C, D and T are in one line. Measure AB and BH.

Then $\frac{TF}{FC} = \frac{DE}{EC}$ or $\frac{TF}{AH} = \frac{DE}{AB}$;

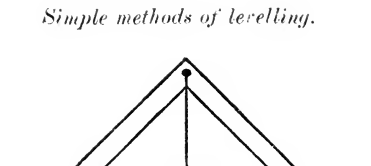
$TF = \frac{DE \times AH}{AB}$.

The height of the tower = TF + AC.

Or plant any stick vertically and measure its shadow; at the same time measure the shadow of the object whose height is required.

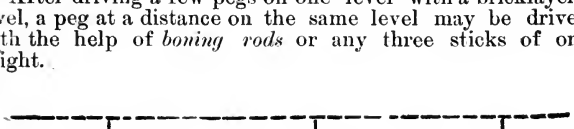
$$\text{Then } \frac{\text{Height of object}}{\text{Its shadow}} = \frac{\text{Height of stick}}{\text{Its shadow}}.$$

Simple methods of levelling.



A line at right angles to the plumb line is horizontal.

After driving a few pegs on one level with a bricklayer's level, a peg at a distance on the same level may be driven with the help of *boning rods* or any three sticks of one height.

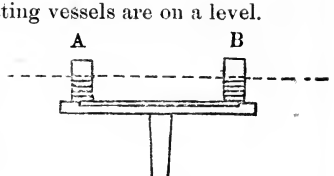


Place two of the sticks over the extreme pegs A and C driven with a mason's level and drive the peg B so that the third stick placed over it is in line with the tops of the other two. Intermediate pegs may similarly be got on the same level.

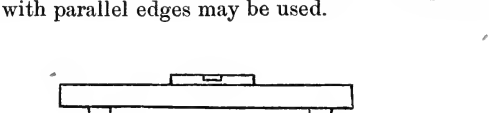
The pegs may also be driven on any required gradient. If AB is 3 feet, place upon B a small plank 1 inch thick and level. The gradient from A to B will then be a gradient of 1 in 36 and so on.

2. Liquids in communicating vessels are on a level.

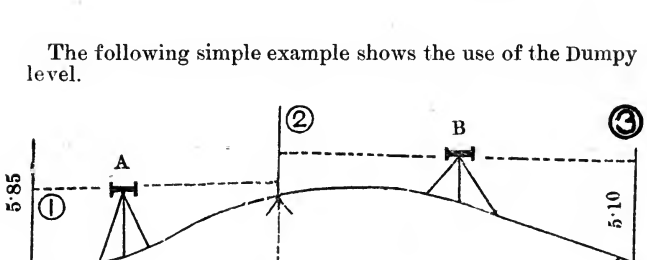
A and B are two glass vessels or bottles connected by a tube AB, containing some coloured liquid and mounted on a stand CD.



3. Instead of a mason's level a bubble tube placed on a plank with parallel edges may be used.



The following simple example shows the use of the Dumpy level.



It is required to find the difference in level between stations (1) and (3). Erect the spirit level at A and take the "backsight" reading on the staff at (1) and the "foresight" on the staff at (2). Then move the level to B and repeat the

same for (2) and (3): the distance between the stations is also to be measured. These observations are entered in columns in the book as follows :—

Station.	Distance.	Staff readings.		Rise.	Fall.	Reduced level.	Remarks.
		Back-sight.	Fore-sight.				
1	.	...	..	...	...	10	Datum line below station 1.
2	155	5·85	1·65	4·20	...	14·20	
3	325	3·25	5·10	...	1·85	12·35	
	478	9·10	6·75	4·20	1·85	12·35	
		6·75		1·85		10	
		2·35		2·35		2·35	

Thus there is a fall of 2·35 feet from (3) to (1) (distance, 478 feet) or 5·9 inches nearly in 100 feet.

BUILDINGS AND ROADS.

Lime absorbs water, or water may be added, when it is called *slaked lime*.

A para of lime is the quantity contained in a box 22 inches square and 10 inches deep (inside measurements), and is thus approximately 2·8 cubic feet. It weighs 60 lb.

2 paras = 1 salagai.

A cartload of lime will be from 10 to 12 paras, i.e., about 30 cubic feet. When slaked this will occupy about twice the space, i.e., 60 cubic feet.

Mortar for concrete :—1 part of lime to 3 of sand : for building and plastering : 1 part of lime to 2 of sand.

The volume of mortar is equal to the volume of sand used : thus 10 paras of sand + 5 paras of lime will give 10 paras of mortar. Twelve paras of mortar will be required for building 100 cubic feet of brick in mortar.

Bricks.

Table moulded bricks :— $9'' \times 4\frac{1}{2}'' \times 2\frac{1}{4}''$.
Country bricks :— $8'' \times 4\frac{1}{2}'' \times 2\frac{1}{4}''$.

For 100 cubic feet of building 1,200—1,300 table moulded bricks are wanted, or 1,500—1,700 country bricks.

One cartload of bricks contains 300 table moulded or 430 country bricks.

Four masons, with four women to assist, will build 100 cubic feet of straight wall in a day : if scaffolding is necessary, the figure may drop to 60 cubic feet.

Surki concrete :—2 parts of mortar to 4 or 5 parts of broken bricks.

One woman will break $\frac{2}{3}$ cubic yard of bricks for concrete in a day.

One mason, with a woman to help, will rough plaster 150 square feet in a day. If the work is properly finished 100 square feet only will be done.

One Madras Measure of lime, mixed with water, will be sufficient for whitewashing 100 square feet, single coat. For second coat half the quantity.

One woman will cover 300 square feet in a day, single coat, 200 square feet double coat.

Metalling Roads.

One man can pick up 500 square feet of metalled road in a day, if the surface be thoroughly soaked : this will drop to 350 square feet if conditions are not so favourable.

For spreading metal, labour may be employed as follows :—3 men filling baskets, 6 women carrying. 1 man taking and emptying baskets, and 2 men sectioning : such a gang will, if the metal is already in heaps on the side of the road, cover 3,000 square feet a day.

[From U.S.A. Bulletin 463.]

Width of roadway in feet.	Area in square yards per mile of length.	Cubic yards of surfacing material required for each 1 inch loose depth per mile of length.
8	4,693	130·3
10	5,866	162·9
12	7,040	195·5
16	9,386	260·6
20	11,733	325·8

To move one ton gross load on a well constructed cart.

	lb.
Loose sand road	315
Earth road, average (dry)	150
Good earth road	100
Gravel road	80
First-class metal road	55

MACHINERY.

Nominal horse-power (N.H.P.) is a general or vague term used to indicate the size of the engine and means the power given out when worked at a pressure of about 30 lb. to the square inch.

Indicated horse-power (I.H.P.) refers to the total power exerted on the piston by the steam or the exploding gases in the cylinder as tested by an indicator. It is usually 2½ times the 'nominal.' Brake or effective horse-power (B.H.P.) is the net useful work transmitted by the driving shaft through a band which acts as a 'brake' to the motion of the fly wheel. It represents the ordinary working power of an engine, and runs about ¾ of the I.H.P., or 1½ times the N.H.P.

One horse-power = raising 33,000 lb. one foot high in one minute or = 33,000 foot pounds = 33,000 units of work. The heat unit, i.e., the energy required to raise 1 lb. of water 1° Fah. is 744 ft. lb., to raise 1 lb. of water 1° C. requires 1,390 ft. lb.

1 lb. of coal yields 14,000 heat units.
1 lb. of kerosene oil yields 20,000 heat units.

The modulus of an engine is the proportion of motive power which is given out as useful work: in ordinary farm machines it is about a half, the other half being used up in overcoming the resistance of the machine itself.

In an oil engine about 60 per cent of the heat is dissipated by the cooling jacket, 25 per cent escapes by the exhaust and only about 15 per cent are ultimately available for transmitting power to other machinery.

Half a pint of oil is supposed to be required per B.H.P. per hour.

Water Lifting.

Water lifted in one hour by various machines.

Picottah (3 men—2 on beam) ...	14 ft.	2,735	gallons.
Mhote	38 ft.	1,523	,,
Oil engine: 3″ pump and 3½ H.P. engine.	25 ft.	12,800	,,

The co-efficient of utility is the amount of useful work done in one hour, expressed in foot pounds, divided by the weight of the animal in pounds, and represents the vertical

height in feet to which by the expenditure of a similar amount of work, the animal's body would be raised.

—	Duration of time of experiment.	Foot-pounds of work done per hour.	Weight of animals.	Co-efficient of utility.
	MINUTES.			
Double mhote Saidapet.	180	413,000	1,146	360
Stoney's improved double mhote.	367	1,709,300	1,146	498
Subba Rao's improved single mhote.	60	500,940	1,348	371
Single mhote Bellary lift of 35 feet.	102	1,337,000	2,688	497
Single mhote Bellary lift of 13 feet.	165	456,400	2,058	222
Picottah	16	375,810	308	1,220
Do.	420	394,310	331	1,191

[Table from Madras Agricultural Department Bulletin 35, by Sir A. Chatterton.]

Amount of water lifted one foot for 1 *anna.*

By bullocks in country mhote (1882 : Benson)	4,000
By bullocks in country mhote : (1907 : Chatterton).	2,000
By oil-engine and pump : under very favourable conditions.	13,500
By oil-engine and pump : under ordinary conditions.	9,000
By oil-engine and pump : under unfavourable conditions.	4,000

The loss of power in a centrifugal pump ranges from 75 per cent for a 2″ suction pipe to 60 per cent for a 3″ suction pipe and 45 per cent for a 10″ or 12″ pipe.

A 3″ pipe will lift up to 22 feet easily and a 4″ pipe will lift up to 28 feet.

The larger the installation the more economically the engine can be run, owing to the increased efficiency of the engine, and the proportionate saving in the establishment.

Actual cost of installations.

Name of station.	Engine.			Pump.			Storage of oil.	Foundations.	Engine shed.	Belting.	Miscellaneous—including circulating cistern and fitting charges.	Total.
	Brake horse-power.	Cost of engine.	Cost of fittings.	Size of pump.	Cost of pump.	Cost of fittings.						
Kuhoor	3½	965	150	3″	285	93	30	40	30	50	82	1,725
Unjalur	5	1,286	77	3″	270	145	20	50	35	31	86	2,000
Bangalaputtur ...	7½	1,546	101	4″	345	165	30	50	35	40	118	2,430
Nellikuppam ...	9	1,794	93	4″	365	128	30	80	50	40	130	2,710
Pallavaram ...	14	2,474	180	5″	450	...	30	80	200	81	175	3,670
Katalai	25	4,423	730	12″	1,265	445	150	200	750	123	404	8,490

Vide Appendix to "Lift Irrigation," by Sir A. Chatterton.

Duty of water.

The duty of water is the irrigation work which a given quantity of water can perform and is usually shown as the number of acres on which a crop can be irrigated by a continuous flow of water at the rate of 1 cubic foot per second. The duty of water when used to cultivate paddy is much less than when irrigated dry crops are grown. For tank irrigation which is generally wasteful, the duty may be taken as 50 acres : in large irrigation systems, where the water is under proper control, the duty will be as high as 100 acres. For water lifted from wells by engines and pumps the duty may be taken as 240 acres ; actual experiment at Coimbatore with water lifted from wells gives 280 acres. At Cawnpore where sugarcane needed 50 acre-inches of water, the duty is 171 : for wheat 347 and for maize 192.

Amounts of water needed for irrigated crops.

(Exclusive of rain-fall.)

Crop.	Duration.	Inches.
Paddy	5 months ...	37
Ragi, monsoon crop ...	3 „ ...	9
Ragi, hot weather ...	3 „ ...	13
Cholam	4 „ ...	10
Sugarcane (Cawnpore) ...	12 „ ...	50
Maize (do.) ...	4 „ ...	15
Wheat (do.) ...	4 „ ...	8

Water data.

1 cubic foot water = 62·425 lb. = ·557 cwt. = ·028 tons.
1 cubic inch = ·03612 lb.
1 gallon = 10 lb. = ·16 c.ft. = 277·274 cubic inches.
1 cubic foot = 6·25 gallons (6¼ gallons).

Gauging water.

1. Through a sluice or submerged opening

$$Q = A \times V = A \times 5 \sqrt{H}$$

where Q = quantity in cusecs (c. ft. per second).
A = area in sq. feet of the opening through which the water passes.
H = height of water in feet above the centre of the opening.
Q × 375 = gallons per minute.
V = Mean velocity of water approaching the opening in feet per second.

2. Over a weir or plank, free overfall.

$$Q = H \times L \times V$$

where H = height of still water above crest in feet.

L = length of crest in feet.

V = mean velocity of water approaching the crest in feet per second $= \frac{2}{3} \times 5 \sqrt{H}$.

Q = quantity discharged over the crest in c. ft. per second.

In gauging, the water must all be made to pass over a rectangular aperture in a thin board. The height must be measured from the top of the crest to the level of the surface where it is not affected by the curve of the overfall.

Storage.

It is usual to assume that an acre of crop will require an acre-fathom (6 ft.) of storage in a tank if the latter is the source of supply. Rain is required to supplement this supply as also to make up for the loss due to evaporation which may be taken as ·4 inch as a maximum figure on a very hot day. It is less proportionately in deep tanks than in shallow ones.

Capacity of a tank may be roughly taken to be = area of waterspread at F.T.L. (full tank level) $\times \frac{1}{3}$ of the depth of the lowest sluice.

Velocity and discharge of minor irrigation channels.

The average velocity of water flowing in a channel may be taken as 4/5 of the surface velocity which may be easily ascertained by means of a float floated down a measured distance. The average velocity of an earthen channel should ordinarily be more than one foot per second and less than three feet per second. If less than one foot per second, there will be a free deposit of silt and the channel will be choked with aquatic plants. If more than three feet per second, the water will cut its own banks and bed and take a new course.

The velocity of a channel depends upon the depth of water flowing as well as the fall of bed. If the depth is great as in large rivers, the bed-fall will have to be small so that the velocity may not exceed about three feet per second. In small channels where depth is limited the bed-fall will have to be great to secure the proper velocity. The bed-fall is usually half to two feet per mile in large rivers, five to ten feet per mile in canals, and 20 to 25 feet per mile in very small channels, 25 feet per mile = 1 in 211 or say 1 in 200.

For small masonry channels where friction is less and therefore velocity greater, a fall of 1 in 300 or 400 may be given.

Discharge of channel = A×V cusecs, where A = area of cross section of stream in square feet and V = average velocity in feet per second.

Draught of carts.

The force of traction of a cart along a level fairly metalled road is about 1/21 of the weight of the cart with load. To move a loaded cart weighing one ton, with the wheels well greased along such a road, will require 107 lb.

Up a gradient of 1 in 100 the draught will increase by 1/100 of a ton, i.e., 22·4 lb. = total 129 lb.

Weights and draughts of various implements.

	Weight. LB.	Draught. CWT.
Country plough	50	2½
Sivagiri plough	50	2½
Meston plough	36	2½
Monsoon plough	60	3
Sabul plough	120	3½
Howard plough	110	5
Steel Eagle plough	135	6
Gallows plough	250	6
3 furrow S.E.E.D. plough ...	300	3½
Double disc plough ...	1,000	7
Flexible harrow	240	3
Disc harrow	1,500	7–12
Cambridge roller	1,500	4
Buck scraper (empty) ...	430	...
Do. (full) ...	...	11
Junior hoe	55	1½
Martins cultivator	440	...

LABOUR.

Cane harvesting.—For cutting 10 cents of cane 9 to 12 men will be needed. For cleaning, stripping, topping and bundling 10—14 women. Carrying will depend on the lead. At 20 tons to the acre of cleaned cane, there will be 2 tons from 10 cents; this will be crushed by a three roller mill with two good pairs of animals, working in shifts in 12 to 14 hours. The juice from this will be 2,800—3,000 lb. One man to feed canes, one boy to drive, one boy to remove megass and help generally. A pan holds about 400 lb. and will give about 90 lb. of jaggery.

Carting *manure.*—Two carts, one left for loading while the other goes to the field, one pair of cattle, one driver and two men loading will fill and take to field ten carts per day with a lead of not more than half mile.

Carting silt.—The same as above, but one man for loading may be enough.

Clearing, heaping and burning scrub jungle for *modan* paddy. Malabar:—Five men and five women per acre.

Clod crusher.—The area worked by this daily depends on the state of the land, i.e., the size and hardness of the clods, and will vary from 1 acre with two pairs and a loaded crusher, to 3 acres with single pair in light land.

Cotton ginning.—One woman will beat and gin 25 lb. of cotton per day. Tinnevelly:—One woman gins 3 edai or 31 lb. in a day.

One man will keep about 12 ginners (on piece work) supplied for a day.

A double roller gin will clean from 2,000 lb. to 2,500 lb. of ordinary cotton in a day's work of ten hours. Nadam cotton is harder to gin and only about 1,500 lb. will be put through in a day, while with Cambodia as much as 3,000 lb. per day may be finished.

Crowbarring.—Thirty-three to forty men working in gangs of two, one digging and the other turning over clods, will dig one acre a day.

Digging *wet land with mamuty.*—In Tanjore district 12 men per acre for first digging; 8 men after first puddling. At Coimbatore it takes 16 men.

Cultivating.—The Martin's cultivator at Coimbatore with two pairs of cattle covers 4 to 5 acres per day.

With the gorru worked as a cultivator, 3 to 4 acres a day.

Working guntaka.—With a 3-foot blade, a man can cover 4 to 5 acres per day.

(i) With Pedda guntaka (Black cotton soil previously ploughed with B.C.S. plough) four pairs of cattle and four men will cover one acre per day.

(ii) With ordinary guntakas weighted and worked deeply : one man and one pair will cover 2 acres per day ; if worked merely for the purpose of creating a mulch and removing weeds, 3 to 4 acres may be covered according to the weediness of the land.

(iii) With guntaka to cover seed : with a 4-span guntaka 4 acres will be covered ; if two are fixed to one yoke and a boy used to guide, from 6 to 8 acres will be covered per day.

(iv) With guntaka to remove cotton or jonna stubble, about 1 acre will be cleared per day.

Chaffing fodder.—This depends mainly on the length into which the fodder is cut. One man will cut 840 lb. of cholam fodder per day into pieces 24 inches long. With 8-inch machine needing 2 horse-power to drive it 8,000 lb. of cholam fodder can be cut in a day of 8 hours into lengths 1½ to 2 inches long.

Drilling.—A team consists of one pair with three-tined gorru, tines 10 inches apart, one pair with guntaka, two drivers and one or two women (if mixed crop) and they will drill 2½ acres a day, working the guntaka before and after the drilling. If the seed is drilled on the unworked land, one guntaka will keep pace with two gorrus.

(i) *Two-tined gorru.*—Used for cotton with tines 1½ feet apart. One man to drive, one boy or woman to sow, will do 4 or 5 acres in a day.

(ii) *Three-tined gorru.*—Used for jonna, one man to drive and sow, one boy to weight when needed and one pair, 3 or 4 acres per day. Used for cotton (as in Kurnool), the middle tine plugged, the boy may be dispensed with, and the area turned out will be 4 acres.

(iii) *Six-tined gorru.*—With another man to sow, and the same labour as shown for the three-tined gorru used for jonna, double the area may be turned out. Usually the implement needs to be weighted.

(iv) *Plough and akkadi.*—One pair and two men (1 for plough, 1 for akkadi) about 1 to 3 acres will be sown per day according to the crop sown.

(v) *Gorru and akkadi.*—(As for cotton in Bellary district) one pair of cattle and one driver, and a cooly for each akkadi, 3 to 4 acres will be sown in one day.

Extracting fibre—*Agave fibre.*—One man and one woman will extract 50 lb. of dry fibre in a day from fresh leaves.

Coir fibre.—A woman can beat out 25 lb. of coir fibre per day.

Gogu.—Cutting or pulling crop, 10 women or 10 men. Bundling, 6 women per acre. Retting, 2 men will arrange the bundles and weight them off one acre (20,000 lb.), while in stripping, 3 men will supply stalks to 30 women or boys who will strip the above amount and produce 800 lb. of dry fibre per acre.

Sunnhemp.—The fibre is obtained by beating the retted stalks in water. Forty men will cut and beat the produce of one acre (15,000 lb. of green stalks) and obtain 600 lb. of dry fibre per day.

In Tinnevelly reaping the crop and bundling Rs. 4 per acre.

Grinding—*Cotton seed.*—This may be done wet as in Coimbatore where a woman or boy will do 7 lb. per hour, i.e., 50 lb. per day, enough for 17 animals, or dry as in Ceded districts where two boys sitting on either side of large stone will crush 100 lb. per day.

Harrowing—*Brush harrow.*—A number of branches (weighted) drawn by a pair ; covers an area of 5 to 6 acres of a sown field.

The Sampson harrow works 2½ to 3 acres a day in open fields or if the crop is not too high.

Seed harrow covers about 5 to 6 acres a day.

Harvesting—*Bengal gram.*—This is pulled out of the ground and needs 5 to 6 women per acre.

Cholam.—Three women will cut the crop off an acre and 5 women will remove the heads. The heads (850 lb.) of an acre will fill 1 or 1¼ carts, and 1 man and 2 boys will be needed to load and remove to the floor. Bundling and stooking is generally done by men and needs per acre 4 men. The straw [4,000 lb.] off an acre will fill four carts.

Fodder Cholam.—One woman will cut and bundle 1,000 lb. a day.

In Tinnevelly, on black soils, 2 men and 8 women will cut and bundle 1 acre of fodder cholam, i.e., about 1 ton.

Cotton picking.—In a heavy crop 1 woman will pick 25 to 30 lb., but in a poor crop the quantity may be as low as 10 lb.

In Cambodia cotton, as much as 100 lb. per day may be picked by a woman in a good season.

Cumbu.—Twelve to twenty women for cutting earheads and 6 to 8 women for cutting straw, depending on the size of the crop.

Removing cotton stalks.—Four to five men will clear an acre. (*See* Guntaka above.)

With the cotton puller (LEAFLET XIX of 1911) the work can be done in the dry weather by 5 women or less per acre.

Groundnut.—In South Arcot, the land is dug over by 12 to 15 men with the mamuty and 5 women to each man collect the nuts, i.e., 75 to 80 women per acre. A rainfed crop may be ploughed with a country or special plough and the nuts collected by hand, if the land is sandy.

Sweet potatos.—Forty men to dig and 30 women to turn over and collect the vines and tubers.

Onions.—Digging, lifting, carrying and cleaning 10 men and 60 women.

Other pulses.—The crop will be picked over two or three times and may need each time 4 to 5 women per acre.

Paddy.—Six to ten men or 10 to 12 women will reap the crop. Bundling and carrying to the floor close by, 2 men and 4 women. Stacking if done preparatory to threshing, 1 man per acre.

Ragi.—Twelve to sixteen women to cut heads off an acre on two occasions and 6 to 8 women for cutting straw.

Tenai.—In Ceded districts for a mixed crop of Korrapathi, 6 women per acre. For a pure garden crop 10 women per acre.

Tobacco harvesting.—Four men will harvest an acre in a day cutting the leaves off the stalks ; 2 men and 10 women will carry and stack the produce.

Stripping and bundling.—Six men and twelve women drying, and heaping 6 men. Finally 8 men and 12 women will open, sort and rebundle leaves and sprinkle salt water on them.

Turmeric.—Twenty men and forty women will dig or clean an acre in a day.

Husking—*Paddy.*—Two women should finish a selagai (160—170 lb.) in 5—6 hours. They may do as much as 1½ selagais per day. A cooly of paddy, i.e., one day's work is 16 Marakkals for which 1½ M.m. are given.

Interculturing—*Bullock hoeing.*—With dantulu, about 2 acres for each danta, i.e., for three, 6 acres per day, for four, 8 acres a day. In the Ceded districts it is not uncommon to cover 9 to 10 acres in a day.

(i) By hand, usually combined with weeding. For a fairly clean field of jonna, 3 to 10 coolies will cover 1 acre, a weedy field will take up to 40 per acre depending on the weediness.

(ii) *Cotton with guntaka.*—One man and a pair, 3 acres per day.

(iii) With a plough from ¾ to 1 acre per day.

Planting—*Canes.*—Six men and ten women will cut, strip, carry and plant an acre in a day using 10,000 to 12,000 sets. If the rate is 20,000 to 25,000, 10 men and 16 women will be needed.

Coconuts—

Digging 80 pits per acre	40 men.
Manuring	20 „
Planting	4 „

Kiluvei hedge.—One man can do 16—30 yards fence a day depending on thickness of hedge, and his skill. Twenty cuttings per yard at 1½ lb. per cutting.

Chillies and other garden crops.—Four to eight women are sufficient per acre.

Paddy.—One man or woman will lift seedlings, bundle and clean them for 4 to 5 women depending on the distance of the seed-bed. If seedlings are supplied it will need 12 to 15 women to transplant an acre. If the planting is done singly, when the women become accustomed to it, they will plant more quickly.

A gang will be allotted in the following proportion : 6 ploughs, one levelling board, 6 men or 8 women lifting seedlings, 3 to 6 boys carrying seedlings and 25 women transplanting.

Bundling seedlings in a paddy seed-bed.—A man will pull and bundle about 1 cent per day, i.e., from 200 to 250 bundles. On contract he will do at least twice as much and will be paid at the rate of ¼ to ½ an anna per 20 bundles. 1,000 to 1,500 bundles will be sufficient for transplanting an acre singly.

Onions.—20 to 40 women transplant one acre in a day according to the spacing of the bulbs.

Pepper.—Digging holes and planting 400 standards per acre, 12 men ; digging pits and planting pepper cuttings, 12 men per acre.

Plantains.—Digging 900 holes 1 foot deep per acre, 4 men ; lifting suckers, 4 men ; planting, 8 men ; pressing, 18 men.

Groundnuts.—Dibbling, 15 women per acre including weeding, exclusive of weeding, 10 women in cumbu and 12 in ragi.

Ragi.—Generally planted singly. Three women will lift seedlings for 15 women to plant. For planting in ridges 10 to 12 women per acre, and for beds 14 to 16 women per acre are required. One man and two women plant an acre of dry ragi a day.

Turmeric.—Behind plough, one and a half pairs and drivers with 4 or 5 boys will sow an acre in the day.

Ploughing.—First ploughing with the country plough in dry land, half acre for each pair daily. There should be no ridges left between the furrows.

In subsequent ploughings the plough takes a little more land and the area covered is about ¾ acre daily.

In ploughing to cover seed an acre a day may be expected. In wet land (puddling), generally with inferior animals, 25 cents the first time, about 35 cents the second time and half an acre for third and subsequent ploughings. With black-cotton soil iron plough, four men and four pairs will plough 40—60 cents; when the soil is very hard, another man is required.

Gallows plough with two pairs will do 50 cents a day unless the lead is very short. In Ceded districts half acre can be ploughed daily with the cotton soil plough, using four pairs of cattle. In places where this implement is newly introduced, the work turned out is less, only one-third of an acre being ploughed daily.

R.I.S. plough and Turnwrest plough—40 to 50 cents a day.

Ridging.—A man with Ransomes double mould board plough and a pair of cattle can ridge up to 1½ acres a day (ridges 1½ feet apart) in land already well ploughed.

Rope-making.—One man and one woman or boy will twist 30 to 38 lb. of fibre into rope in a day.

Twists of straw for packing grains are made 30 feet long, and 2 men can make 40 twists in a day.

Sowing *broadcast.*—A man will sow 1 acre an hour. To cover this one man and a pair of bullocks will take one full day.

Sowing modan (dry land) paddy in Kalabar.—Eight men will carry to the field sow and rake in the seed for an acre (about 60 lb.).

Groundnuts.—Three pairs of cattle and 6 women extra will do an acre in half day, that is 2 women or men behind each plough, if sowing is done in every furrow.

Spreading.—*Manure.*—The heaps are generally one cartload (10 cwt.); with light dressings (15 to 20 cartloads) 6 women per acre will spread; as the heaps get closer there is less lead but more stuff to carry, so for heavy dressings 8 women will be needed per acre.

One man will spread 8 cartloads per day. Applying castor cake to sugarcane, 1 man will apply one bag and for every 4 men, 1 woman or boy will be required to carry.

Thatching.—One man will thatch 400 square feet per day with a woman to help.

Threshing—*Cholam.*—The heads are spread out on the floor and are either beaten by sticks or are pressed under the stone roller. One man will beat the produce of an acre (1,000 lb. of heads or 600 lb. of grain) in one day. With roller two pairs of animals with drivers, and 2 men and 4 women will thresh out 6,000 to 7,000 lb. of grain in a day.

Threshing by bullocks.—A team consists of four animals with driver, 2 men to turn heads and 2 women. They will thresh 1,300 lb. of grain per day.

For threshing with machine, 2 men to feed the machine, 1 woman to supply heads, 5 women to collect and remove the empty heads after the second threshing, and 1 woman to collect the grain into a heap 15,000 lb. per day of eight hours.

Paddy.—This is usually threshed in two operations. The heads are first beaten against a board and 90 per cent of the grain removed. One man with a woman or boy to hand him the bundles can thus beat out 2,000 lb. a day. The straw is afterwards trodden out by cattle. In this second threshing roughly, 16 bullocks with 4 boys to drive will thresh out 2,000 lb. per day while six will stack the straw in the same time.

If the paddy is trodden out directly by cattle, a team of 16 cattle, i.e., four yokes of four each with 4 men or boys to drive, and 3 men to turn the straw, will thresh out 7,000 lb. of grain per day.

Bengal gram.—With the stone roller, a team of two pairs 2 drivers and 3 women will thresh 4,000 lb. per day. If the stuff is trodden with cattle 16 bullocks and 7 men or boys will thresh 5,000 lb. per day. If threshed with sticks 1 woman can thresh out 80 lb. grain per day.

Ragi.—Two pairs of cattle, 5 men and 2 women can thresh about 2,000 lb. per day.

Cumbu.—Two pairs of cattle, 2 men and 2 women thresh 1,500 lb. per day.

Trenching.—For cane, 25 men per acre.

Watching paddy.—One *palikapu* to watch and irrigate 50 acres if in one block.

Weeding *by hand.*—Three to five women will weed an acre of land. The figure varies very much with the state of the land.

Winnowing 18-*inch machine.*—One woman turning, two supplying and one collecting will clean 3,000 lb. of cholam, 1,000 lb. of paddy, 1,500 lb. of ragi or tenai and 2,250 lb. of cumbu in a day. (Half the quantity noted above of cholam, if machine threshed, on account of the presence of glumes.)

Wrapping—*Canes.*—First time 15 men per acre to wrap and 5 boys to remove rubbish and weeds.

Second time 20 men to wrap and 10 boys to remove rubbish.

Third and subsequent 25 to 30 men to wrap and 1 or 2 boys to remove rubbish.

Fixing bamboos.—(3,000 to 3,500 per acre.) One man will fix about 300 bamboos per day.

*Cost of Labour by Piecework or Contract or Share System.

Cotton ginning.—Three annas per maund of 26 lb of kappas. Eight pies an edai in Tinnevelly. Ten to twelve annas by machine for 250 lb. of kappas, Rs. 5 per candy (500 lb.) of lint.

In Tinnevelly Re. 1 for 247 lb. of kappas.

Cotton picking.—Usually on the share system, one-tenth to one-sixteenth according to the ease of picking and the yield of the season crop. Out of season, it may go down to one-third.

Cotton stalks, removing.—This can be done at Rs. 1-4-0 per acre. It is much cheaper with the puller. (See page 36.)

Crowbarring.—In Coimbatore Rs. 10—15 per acre in wet lands. Rs. 7—10 per acre in wet lands in Gōdāvari.

Dry lands Rs. 6 to 8 per acre in the Gōdāvari.

South Arcot Rs. 12 to 15 per acre.

Cumbu harvest.—One-sixteenth to one twenty-fourth of the produce (Tinnevelly).

Digging Hariali.—Coimbatore, Rs. 32 in black soils and Rs. 37 in red soils per acre. The contractor is bound to clear anything left in the next year, pending which one-tenth of the sum is withheld. Rs. 5 extra per acre, if the work is in patches.

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* These are all at pre-war rates and will in most cases have to be considerably increased.

Digging cane stubbles in wet lands Rs. 7½ per acre. In Gōdāvari Rs. 5 per acre.

Digging with mamuty.—Ceded districts, Rs. 2-5-0 per acre in wet lands. Coimbatore, Rs. 4½ in wet lands. Kulivettu or levelling wet lands : 1 Kuli = 4 Koles, i.e., 48 ft. × 3 ft. × 9 in. the rate for this is 2½—3 as.

Digging wells.—One niluvu or man's height and 4 feet diameter :—

	RS.	A.	P.
First niluvu	0	12	0
Second „	1	4	0
Third „	1	8	0
Fourth „	3	0	0

Fibre extraction.—In Gōdāvari, one-eighth of the fibre in a good crop of sunn-hemp to one-fourth in a bad crop, is given for cutting, retting, stripping and washing.

Groundnut lifting.—Contract Rs. 10 per acre, for a rainfed crop or else for one-fourth to one-eighth the crop ; or piece-work 2—4 pies for every marakkal (2 Madras measures), the higher rate being for the rainfed crop.

Stripping nuts off haulms : 2 p. a Madras measure : picking nuts out of ground after they have been dug : 9 p. a Madras measure (Pollachi).

Penning cattle.—In Ganjām, Re. 1 for a herd of 100 to 150 cattle for one night : in Tanjore, 4 to 6 marakkals of paddy per 100 or, 1 rupee and 2 Madras measure rice.

Hurdles.—Ordinary tattis of split bamboo, 2 annas per square yard inclusive of the cost of the material. Trellis work 3—3½ annas per square yard.

Paddy.—Reaping, threshing and cleaning are done in Gōdāvari at one-tenth of the crop. Reaping : carrying and first threshing : one twenty-fourth of the crop (Pollachi).

Planting is done on contract in Tinnevelly in some parts at 42 Madras measures of paddy per acre. Paddy seedlings in Tanjore are pulled by men at 1½ to 2 pies a big bundle. Reaping, binding and taking to threshing floor in Coimbatore at three selagais of paddy for 3·20 acres crop.

In Tanjore 72 Madras measures per acre for harvesting, threshing and stacking per acre ; or one Madras measure for every kalam (24 Madras measures) of paddy threshed and cleaned. Stacking extra labour : 1 man to 20 women harvesting ; thus.

	Madras measures.
For 30 kalams cleaned and stored	30
Two Madras measures extra for 8 men ...	16
Wages of 1 man stacking	2
	48

In Malabar one-seventeenth of the crop for harvesting only.

Husking.—2½ M.M. of paddy or 1¼ M.M. of rice for every 96 M.M.

Picking chillies.—One twenty-fourth of the quantity picked.

Picking coconuts.—One nut for every five trees picked or 3 pies for every tree.

Coimbatore rate : 7 coconuts peeled for every 100 coconuts picked from trees and peeled free of outer coat and given ready for sale.

In Gōdāvari two nuts for every hundred picked and from 4 annas to 10 annas per 1,000 for removing the outer covering.

Ploughing.—with cotton soil plough Rs. 5 to Rs. 8 per acre.

Prickly-pear : clearing.—This varies widely with denseness of the pear and the thoroughness of the eradication. Probably, in very few cases, should Rs. 50 an acre be exceeded for complete removal. This will of course spring up again, unless the land can be subsequently ploughed.

Rope making.—Twelve annas for making a mhote rope of 25 lb. of fibre and 4 annas for a tail rope.

Sawing timber.—varies with the hardness and dryness of the wood. In Coimbatōre a unit is 12 square feet and for sawing a surface of this dimension the charge is 6 annas.

Sheep penning.—Three-hundred sheep per day per rupee ; at 3,000 sheep per acre, this comes to Rs. 10 per acre.

In Tinnevelly 2,000 sheep for Rs. 7 ; 350 cattle for Rs. 5 to Rs. 7. Tanjore : 1 thundu of 100 sheep for 3 marakkals paddy.

Straw twists.—One hundred twists of 30 feet length for Rs. 1-4-0. In Tinnevelly 12 annas for 100 twists of 30 feet length.

Sweet potatos.—On sandy soils one-tenth to one-eighth is paid in kind for lifting ; contract price on heavy soils Rs. 10 to Rs. 12 per acre.

Threshing cholam.—One-eleventh to one-twelfth the produce in grain for threshing by hand (Guntūr).

Turmeric.—Annas 2 per cent dug : ½ anna per maund for cleaning.

SOILS.

Soil is the uppermost layer of the earth's surface, and consists of the more weathered portions of the rocks of which the earth is composed. It is immediately underlain by the subsoil. It consists of stones, gravel, sand, silt, clay and organic matter in varying proportions.

Classification of Soils.

	Per cent clay.
Sandy	under 10
Sandy loam	10—20
Loam	20—30
Clay loam	30—50
Clay	over 50

Besides this we may have calcareous soils, containing over 20 per cent calcium carbonate, humous soils with more than 5 per cent organic matter, and gravelly soils containing varying quantities of gravel or kunkur.

Residual or sedentary soils are those formed *in situ* from the disintegration and decomposition of rocks.

Transported soils are formed from disintegrated and partly decomposed rock, but instead of remaining in the place previously occupied by the rock, they have been transported and retransported by various agencies such as wind and water to the place where they are now found.

Rock-forming Minerals.

Felspar, an anhydrous double aluminium silicate with potash, soda or lime. Orthoclase is a potash felspar and is the commonest. Felspars on decomposition give rise to clay which is a hydrated aluminium silicate, or laterite.

Quartz.—Silica or an oxide of silicon. It is found in all crystalline rocks and forms the bulk of ordinary sand where it is often coloured red with oxides of iron.

Mica is found in many volcanic rocks and is a constant constituent in the gneissic rocks of Southern India. It is extensively quarried in Nellore.

Carbonate of lime commonly found as accretionary deposits of kunkur or nodular limestone.

Chemical Analyses.

An exact chemical analysis of a soil may be useful as showing any deficiency in plant food, but it is not generally of great practical use, because it does not show in what state the elements exist;—whether suitable for plant food or not. Analyses may, however, show the *available* amounts of the plant foods present by the use of a 1 per cent solution of citric acid (Dyer's method). This is purely empirical, but has been found to give good results. Mechanical analyses show the sizes of the particles composing the soil which are usually given in six grades. Analyses of three classes of soils at the Coimbatore Central Farm are given below. They represent "dry red," "garden" and "black" soils respectively.

Constituents.	Garden land, Number 20.	Dry red land, Number 10.	Black soil, Number 13.
Sand and insoluble	79·040	86·780	78·50
Fe_2O	4·730	2·250	3·06
Al_2O	6·680	4·190	7·06
CaO	1·500	1·520	3·67
MgO	·920	·490	1·49
K_2O	·530	·210	·39
Na_2O	·120	·180	·18
CO_2	·540	·660	1·30
P_2O_5	·115	·028	·05
SO_3	·030	·011	Trace.
Loss on ignition	5·795	3·681	4·24
Total ...	100·000	100·000	100·00
Nitrogen	·0567	0.037	·034
K_2O available	·018	·008	·003
P_2O_5 available	·036	·011	·015

MECHANICAL ANALYSES.

Constituents.	Number 20.	Number 10.	Number 13.
Fine gravel	6·3	18·3	9·5
Coarse sand	17·4	41·1	25·0
Fine sand	19·1	15·1	15·1
Silt	6·5	2·1	6·4
Fine silt	21·1	9·8	28·1
Clay	25·7	12·4	12.0
Moisture, etc.	3·9	1·2	2·8

MANURES.

Average Analyses of Cattle Manure.

—	Box. Per cent.	Heap. Per cent.	Pit. Per cent.
Moisture	50	18	56
Organic matter	27	30	16
Insoluble mineral matter.	15	42	19
Nitrogen	·97	·623	·527
Phosphoric acid	·476	·404	·335
Potash	1·79	1·23	·996

One cartload of farm-yard manure (10 cwt. or half a ton) will contain—

5 to 8 lb. nitrogen.
5 to 8 lb. potash.
2 to 4 lb. phosphoric acid.

Measurements made at the Central Farm with pitted dung and large box carts give the following :—

One cart holds 15–20 cubic feet. The weight of 1 cubic foot is 70 to 80 lb.

Manure produced by Stock per annum.

A pair of animals may be expected to produce 3 tons of farm-yard manure in twelve months, including litter and moisture. The figure naturally varies considerably.

Nitrogenous Manures.

Nitrogen is the most important constituent in the cakes which form so important a manure for many crops. This substance can also be purchased alone in various forms. The following shows the percentages of nitrogen, they should contain—

Nitrate of Soda—15-16 per cent.
Nitrate of Potash—13 per cent.
Nitrate of Lime—13 per cent.
Sulphate of Ammonia—20-21 per cent.
Calcium Cyanamide (Lime Nitrogen : Nitrolim)—20 per cent.

Phosphatic Manures.

Phosphorus is usually supplied as ashes, or in the form of cake or fish manure, but it can be purchased in a more concentrated form as bone meal, bone superphosphate, steamed bones, rock superphosphate or basic slag (Thomas phosphate).

Average analyses of these manures are given below :—

	Water.	Organic matter.	Nitrogen.	Phosphoric acid.	Lime.
Bone meal	6·0	30·3	3·8	23·2	31·3
Bone superphosphate ...	13·0	24·0	2·5	16·7	...
Steamed bones	5·2	17·5	1·6	30·9	41·8
Rock superphosphate ...	14·0	7·0	·6	16·1	...
Basic slag	3·4	..	...	19·0	45·0

The phosphoric acid in superphosphate is in a soluble form and is therefore considered more valuable. For wet lands, however, it is doubtful whether this is necessary, and bone meal or fish manure are probably better. Steamed bones are rich in phosphoric acid, but have lost a proportion of their organic matter. Thomas phosphate contains a large proportion of lime and is valuable in acid soils, but is heavy and expensive to transport. It should be ground to a very fine powder.

Potash.

Potash may be supplied as potassium sulphate, potassium chloride (Muriate of potash), or Kainit. It is not generally considered an important manure for South Indian soils, though if analysis shows less than ·25 per cent of total potash in a soil, experiments should be tried with potash manures. Kainit is a mixture of potash and magnesium salts and contains often fairly large quantities of common salt. Its use is practically unknown, most experiments with potash having been carried out with the sulphate.

Common Manures.

Analyses of cakes.

—	P_2O_5.	K_2O.	N.
White castor	2·61	1·24	6·42
Black castor	1·86	·70	4·50
Pungam	1·34	·66	3·58
Neem (Margosa)	1·31	1·69	5·04
Groundnut	1·40	1·21	8·04
Safflower	1·48	·82	5·83
Punnai *	1·08	1·55	2·65

Castor cake.—This is universally esteemed for the cultivation of the sugarcane crop to which it may be applied at a rate of 1,000 to 2,000 lb. per acre. A common application in Gōdāvari is 10 bags of 164 lb. each, given in two applications. Its cost is about Rs. 80 per ton. As will be seen from the analysis it is a general manure. It is known as black or white cake according to the proportion of husk left in.

Groundnut cake is not considered so good as castor cake for canes, but is largely used for paddy in certain districts. It is generally better to use it as food for cattle and return its constituents to the soil in the shape of dung.

Margosa cake made from the seed of the neem tree, which is collected by women and children from under the trees. The oil is used medicinally. The use of this cake could probably be extended.

Pungam cake used in many places where it can be bought as cheap as Rs. 35 a ton.

Fish manure (*ordinary*).		*Fish guano.*	
Water ...	6·5 to 15·0	Water	8·26
Organic ...	36·5 to 60·0	Organic	66·88
Ash ...	18·4 to 41·0	Ash	24·86
			100·0
N ...	4·4 to 6·8	N	8·40
P_2O_5 ...	3·9 to 5·3	P_2O_5...	8 63
K_2O ...	·2 to ·7	K_2O	0·50

* Calophyllum Inophyllum.

Fish manure.—This is a most valuable manure which is not yet appreciated at its proper worth. It is a general manure, especially rich in phosphoric acid. It can be produced in large quantities on the West Coast. The fish are simply spread on the beach to dry and are subsequently pounded. This generally causes a considerable amount of adulteration with sand which it is impossible to remove completely : good samples, however, should not contain more than 20 per cent by weight. There is also a considerable proportion of oil which partially prevents decomposition. Fish from which the offal has been removed and the oil extracted, are ground up and sold as fish guano which is a dry powder, capable of storage without decomposition and a more concentrated manure than ordinary Milled Fish. There are also other bye-products obtainable which however should not be purchased without analysis.

Tannery refuse.—This may consist of spent bark and of the refuse obtained from the process of tanning. It is reported to be valuable in alkaline lands. Wool, Hair, Hooves, etc., are all waste products which are used as manures. They are mostly nitrogenous, but their use for dry lands is not recommended as they are very slow in decomposition. Round Madras they are largely used for the paddy crop.

Waste from rice mill.		Indigo waste (seeth).	
—	Parts per 100,000 of liquid.	—	Parts per 100,000 of liquid.
Total N	16 to 56	Water ...	12·90
Ammoniacal N ...	8 to 9	Organic.	81·12
Albuminoid N ...	2 to 33	Ash ...	5·98
		Total ...	100·00
P_2O_5	40 to 51	N ...	1·84
K_2O	98 to 129	P_2O_5 ...	·361
		K_2O ...	·277

Mill refuse.—The waste liquor from sugar or spirit factories is, though very dilute, highly esteemed for irrigation and its effects can be seen on the lands near the Nellikuppam and Samalkota factories. Ashes too are largely

available from most factories. The blowings from rice-mills, a very fine dust consisting of particles of bran, husk, etc., may be used with good effect, while the effluent from rice mills could be used for irrigation.

Village earth (*Pati mannu*).

H_2O	4·20
Organic	4·22
Sand	75·51
Fe_2O_3 and Al_2O_3	9·82
CaO	2·60
MgO	·78
K_2O	1·39
Na_2O	·32
P_2O_5	·69
CO_2	·32
Total ...	99·825
N	·094

Village earth.—This may be scraped or brushed from old walls, or dug from pits in old village sites and consists of a greyish powdery earth containing nitrogen, potash and phosphoric acid. It varies largely in composition and is used for paddy and cane, to the former of which crops it has been very largely applied in the Kistna.

Ashes.

	P_2O_5	K_2O
Cane trash	·78	2·51
Cotton stalk ash	1·77	9·35

Village refuse.—This again is a manure which varies very largely in quality. It consists of house sweepings, dung, ashes, and refuse fodder and is the most commonly used manure in South India. If cattle dung largely predominates it is called cattle manure, but is nearly always obtained in a dry and powdery condition.

Green manures (*fresh*).

	N per cent.
Sunnhemp	·708
Dhaincha	·619

The value of these leguminous crops lies partly in the addition they make to the nitrogen in the soil and partly in

the extent to which they ameliorate the physical condition of the soil, when ploughed under. The three commonest are sunnhemp (see p. 76), Wild Indigo (*Tephrosia purpurea*) and Dhaincha (*Sesbania aculeata*). The rate at which these are sown, unmixed and for green manure, is respectively 30 lb., 15 lb. and 15 lb.

Green leaf.—Certain plants are largely cut, especially in the south and used as manure for paddy and sugarcane crops. Wild indigo (*Tephrosia purpurea* : kolinji : vempali) is the most generally esteemed : and is used throughout the Circars for almost all irrigated crops, especially cane but not paddy. Any leaf may be used in the south for paddy, but wild indigo, Madder (*Callotropis gigantea* : erukam : jilledi) and margosa are held the most valuable.

Nightsoil.—The use of this valuable product is being extended in the neighbourhood of the larger towns, especially by those engaged in the cultivation of garden crops. The general method of treating this substance is to bury it in shallow trenches, and allow it to be absorbed by the soil and gradually undergo decomposition. In a few months it will become a dry powder in handling which little difficulty will be experienced.

Lime as a manure.—This substance is a plant food and when lacking, must be supplied to obtain good crops. The quantity needed is however so small that very few soils are without it. Liming consequently is not known. Experiments in its use are in progress at some of the Agricultural stations but little effect has as yet been noted. It has a beneficial effect in soils heavily charged with organic material, and assists in obtaining a tilth on stiff clayey soils while it is said to exert a binding influence on sandy soils. It may be applied as burnt or slaked lime.

UNIT PRICES OF MANURES AVAILABLE IN INDIA.

	RS.
N in ammonium sulphate	12·3
N in nitrate of soda	15·0
N in refined saltpetre	6·7
N in crude saltpetre	6·7
N in calcium cyanamide	10·0
N in calcium nitrate	* 13·0
N in bone meal N in poonacs }	12·0

* The lime has not been valued.

	Rs.
N in fish manure } N in dried blood }	10·0
P_2O_5 in superphosphate	4·8
P_2O_5 in bone meal	·9
P_2O_5 in fish	·9
K_2O in sulphate of potash	3·7

Summary.

Potash	3·5
P_2O_5 soluble	5·0
P_2O_5 insoluble	1·0
N in saltpetre imported	13·0
N in saltpetre	6·5
N in bones, poonacs, etc.	11·0

These can only be taken as approximate.

"Unit" Prices of Manures.

The price divided by the percentage gives the cost of a "unit", i.e., the one-hundredth of a ton. If a standard unit price is adopted, the *real* value of any manure can be found by multiplying the percentage of each ingredient by the standard price and adding all together. The real value can then be compared with the market price.

It is customary in fixing the prices of manures per ton, on the system of valuing by units, to allow only for the phosphates dissolved or soluble, the phosphates undissolved or insoluble, the nitrogen equal to ammonia and the potash. Other items are seldom taken notice of, and in the case of a mineral superphosphate it is not even usual to allow for the insoluble phosphate.

The above prices are of course only approximate, as they vary according to markets, and only represent the value at the ports or manufactories ; the cost of bags, carriage, credit, etc., must be added according to circumstances.

It must be borne in mind that the commercial values bear no relation to the manurial values ; the soluble phosphate in a mineral superphosphate, for instance, being probably as good for the plants as that in a bone superphosphate, although the latter has a higher market value. The cheapest sources should be tried first in experiments.

Relative Manurial Value of Different Manures.

Average of several authorities.

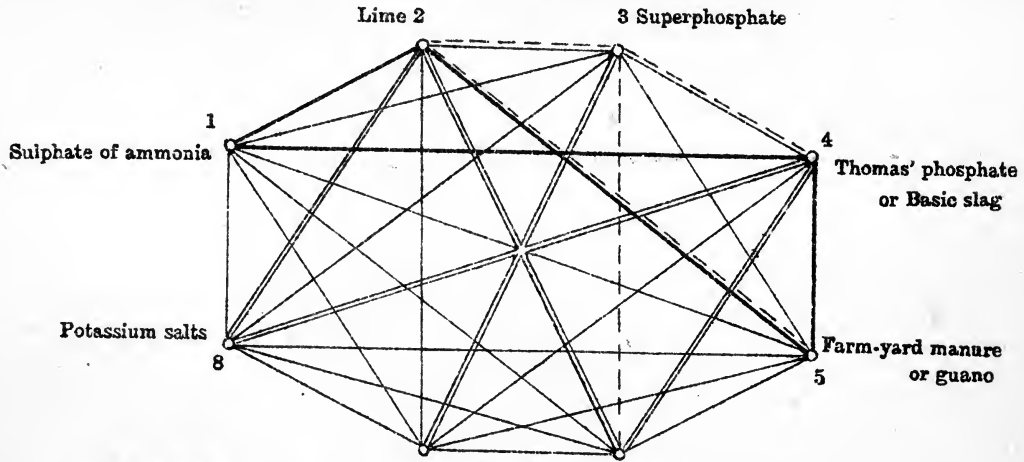
Nitrogen in ammonium sulphate, guano, etc.	100
Do. sodium nitrate	98
Do. fish guano, meat meal, etc. ...	81
Do. bone meal, horn meal, etc. ...	77
Do. farm-yard manure	56
Phosphoric acid in superphosphate	100
Do. guano	92
Do. bone meal	88
Do. medium meal	64
Do. coarse meal	40
Do. basic slag	33
Do. farm-yard manure	33
Potash in sulphate	100
Do. chloride (muriate)	82

Nitrogen, phosphoric acid, and potash are the only three substances which require to be applied in ordinary manuring and most manures are valuable only in proportion to the amounts of these they contain; while manurial experiments usually resolve themselves into testing the effect of the various commercial compounds and mixtures of these three bodies on different soils. The other mineral foods required by plants exist in superabundance in the great majority of soils.

Useful Factors.

Amount of	Multiplied by	Gives corresponding amount of
Nitrogen (N)	1·214	Ammonia.
Do.	4·714	Ammonium sulphate.
Do.	6·25	Albuminoid matter.
Do.	6·071	Sodium nitrate.
Ammonia (NH_3)	0·824	Nitrogen.
Do.	3·822	Ammonium sulphate.
Do.	3·147	Do. chloride.
Do.	3·706	Nitric acid.
Do.	5·0	Sodium nitrate.
Potash (anhydrous) (K_2O).	1·85	Potassium sulphate.
Do.	1·585	Do. chloride.
Do.	2·149	Do. nitrate.
Do.	7·4	Kainit.

DIAGRAM OF MANURES NOT TO BE MIXED



REFERENCE

- Cannot be mixed
- Can be mixed immediately before use
- Can be mixed at any time
- - - - - - - Can be mixed under precautions

USEFUL FACTORS—*cont.*

Amount of	Multiplied by	Gives corresponding amount of
Phosphoric (anhydride) (P_2O_5).	2·183	Tricalcium phosphate
Do.	1·4	Anhydrous monobasic phosphate.
Do.	1·648	Soluble monocalcic phosphate.
Do.	2·555	Tetracalcic (slag) phosphate.
Soluble monocalcic phosphate ($CaH_4\ 2PO_4$).	1·325	Tricalcic phosphate.
Anhydrous monobasic phosphate (Ca_2PO_3).	1·566	Do.
Lime (CaO)	1·845	Do.
Do.	1·786	Calcium carbonate.
Do.	2·43	Do. sulphate.
Magnesia (MgO)	2·09	Magnesium carbonate
Do.	3	Do. sulphate.
Chlorine	1·648	Sodium chloride.

CROPS.

CEREALS.

PADDY.

(*Oryza Sativa.*)

Tamil	Nellu.
Telugu	Vadlu.
Malayalam	Nellu.
Kanarese	Batta.
Hindustani	Dhan.
Oriya	Dhanno.
Tulu	Bar.

Area in Madras—10,943,700 acres.

The number of varieties is very large, even if allowances are made for the same variety receiving different names in different localities. These varieties differ in the colour either of the seed-coat or glume; their duration of growth, from three and a half to nine months; and their quality, i.e., the delicacy and flavour of their rice. The crop is normally grown in wet lands irrigated from canals or tanks (rain or river fed); it is occasionally seen as a garden crop (e.g., Salem, North Arcot, etc) growing in similar conditions. It may be either broadcasted or transplanted. As a dry crop it is extensively found in the Northern Circars and on the West Coast. It is occasionally sown dry and subsequently irrigated.

Seed-rate—Broadcast, 50 to 75 lb. per acre. Transplanted, 20 lb. from 7 cents of land will plant up one acre. But this seed-rate is usually very largely exceeded, up to 150 lb. per acre being used.

Volume weight—1 M.M. weighs 2·5 lb.

Husk to grain—33 to 36 per cent by weight.

Weight of seed—1,000 grains weigh 16 to 25 grammes.

Number of seeds in 1 lb.—18,000 to 27,000.

Germination capacity—90 to 100 per cent.

Yield—Good delta land—2,000 to 4,000 lb. of grain, 3,000 lb. of straw. Average tank-irrigated land—1,500 to 3,000 lb. of grain, 2,500 lb. of straw.

CHOLAM.

(*Sorghum vulgare.*)

Tamil	Cholam.
Telugu	Jonnalu.
Kanarese	Jola.
Malayalam	Cholam.
Hindustani	Juari.
Oriya	Jonna.
Tulu	Ari Jola

Area in Madras—5,219,700 acres.

Varieties—Numerous : see Bulletin No. 55, Department of Agriculture, Madras. It is grown as a dry or irrigated crop on almost any class of soil. It is also grown thickly as a fodder crop when it is not intended to produce grain.

Seed-rate—10 to 15 lb. Irrigated 20 to 35 lb. ; for fodder up to 100 lb.

Volume weight—1 M.M. weighs 3·1 lb.

Husk to grain—14 per cent by weight.

Weight of seed—1,000 seeds weigh 25 to 30 grammes.

Number of seeds in 1 lb.—15,900.

Germination capacity—95 per cent.

Yield—Average produce of garden lands—2,000 to 3,000 lb. of grain, 5,000 to 7,000 lb. of straw.

Dry lands : grain 1,000 lb. per acre in best black soils ; 700 in good red soils ; down to 300 lb. in dry tracts of Ceded Districts.

BULRUSH OR SPIKED MILLET.

(*Pennisetum typhoideum.*)

Tamil	Kambu.
Telugu	Sajjalu or Gantelu.
Kanarese	Sajje.
Malayalam	Kampam.
Oriya	Gantiya.
Hindustani	Bajra.

Area in Madras—3,606,300 acres.

There are long and short duration varieties : varieties are also known in which the grain thrashes free of the husk (*Arisikumbu*). The crop is grown either under dry or garden conditions. The former is sown during the monsoon seasons, and the latter during the hot weather : as a dry crop it generally occupies poor soils, save in Tinnevelly and Rāmnād, where it takes the place of cholam on black soils. It has

wonderful tillering capacity. It is quick growing, and therefore may be raised as a fodder crop though the straw is considered when ripe, inferior in quality to cholam.

Seed-rate—3 lb. in black soils ; others 6 to 10 lb.

Volume weight—1 M.M. weighs 2·7 lb.

Husk to grain—7 to 8 per cent by weight.

Weight of seed—1,000 seeds weigh 4 grammes.

Number of seeds in 1 lb.—111,400.

Germination capacity—93 per cent.

Yield—Up to 1,000 lb. of grain on best black soils. In other soils about 300 lb. is an average crop Productivity inferior to cholam both in fodder and grain.

RAGI.

(*Eleusine coracana.*)

Tamil	Kelvaragu or Ragi.
Telugu	Ragulu, Thamidalu Chodulu.
Malayalam	Muttari.
Kanarese	Ragi.
Hindustani	Ragi.
Oriya	Mandiya
Tulu	Ragi.

Area in Madras—2,600,900 acres.

Varieties—There are distinct varieties for dry and garden lands and for early and late seasons. Plants differ also in the nature of panicles (open or closed). In a few parts of Madras, this is grown as a dry crop (generally mixed with pulses and castor) in the uplands of Salem, Coimbatore and Hindupur, in Vizagapatam, and in valleys near the hills. In some districts it is raised as the first crop on wet lands with limited or precarious water-supply. Elsewhere it is a garden crop, being raised in seed-beds and transplanted in beds or in ridges.

Seed-rate—2 lb. in 2 cents of land for planting out 1 acre. In dry lands about 3 lb. is mixed with pulses.

Volume weight—1 M.M. weighs 3·07 lb.

Husk to grain—5 to 6 per cent by weight.

Weight of seed—1,000 seeds weigh 2·88 grammes.

Number of seeds in 1 lb.—157,500.

Germination capacity—95 to 99 per cent.

Yield—2,000 to 3,000 lb. garden crop. The straw is usually cut and fed partly green, and will weigh up to 8,000 lb. Dry crop, 1,000 to 1,500 lb. of grain and 4,000 lb. of straw.

ITALIAN MILLET.

(*Setaria italica.*)

Tamil	Tenai.
Telugu	Korralu.
Kanarese	Navane.
Malayalam	Tena.
Hindustani	Kanguni.
Oriya	Kangu.

Area in Madras—1,832,000 acres.

There are several cultivated varieties differing in the colour of the seed which may be any shade of yellow to orange, brown or black. Grown as a dry or an irrigated crop on almost any soil. Frequently mixed with cotton as a dry crop ; but is not generally mixed with pulses as other cereals.

Seed-rate—5–6 lb. per acre as a garden crop : half that for dry lands, with further reduction if sown as a mixture.

Volume weight—1 M.M. weighs 3·57 lb.

Husk to grain—20 per cent by weight.

Weight of seed—1,000 seeds weigh 2·70 grammes.

Number of seeds in 1 lb.—168,000.

Germination capacity—95 per cent.

Yield—Dry crop up to 600 lb. Irrigated up to 1,000 lb. ; 1,000 to 2,000 lb. of straw per acre.

SAMAI.

(*Panicum miliare.*)

Tamil	Shamai.
Telugu	Samulu.
Malayalam	Shama.
Kanarese	Shame.
Hindustani	Savan.
Oriya	Suniva.

Area in Madras—1,008,500 acres.

There are long and short duration varieties of Samai : One with black glumes is also known. It is usually grown as an early dry crop, occupying poor soils and is mixed with pulses.

Seed-rate—10 lb. per acre.

Volume weight—1 M.M. weighs 3·1 lb.

Husk to grain—44 per cent by weight.

Weight of seed—1,000 seeds weigh 2·65 grammes.

Number of seeds in 1 lb.—171,200.

Germination capacity—98 per cent.
Yield—400 to 600 lb. of grain ; 800 to 900 lb. of straw per acre.

COMMON MILLET.

(*Panicum miliaceum.*)

Tamil	...	Panivaragu or Kadaikanni.
Telugu	...	Varigalu or Barigalu.
Kanarese	...	Baragu.
Hindustani	...	...
Oriya	...	Rala.

There are two varieties grown which differ in colour of the glume. The crop is grown dry on poor soils : and only occasionally as a garden crop.
Seed-rate—10 lb. per acre.
Volume weight—1 M.M. weighs 3·09 lb.
Husk to grain—35 per cent by weight.
Weight of seed—1,000 seeds weigh 5·12 grammes.
Number of seeds in 1 lb.— 88,600.
Germination capacity—99 per cent.
Yield—500 to 600 lb. of grain ; 900 lb. of straw. An irrigated crop will yield up to 1,200 lb. of grain per acre.

SANWA MILLET.

(*Panicum Crusgalli* var *Frumentaceum.*)

Tamil	...	Kudiraivali.
Telugu	...	Oodalu.

A green and a red variety are found growing in Ganjām : elsewhere there seems to be a single variety. It is a minor grain grown usually on poor soils. It grows very rapidly, can stand water-logging and is therefore raised in low lands to prevent wash. The straw is considered good : grain contains a very high proportion of husk.
Seed-rate—35 lb. per acre.
Volume weight—1 M.M. weighs 2·33 lb.
Husk to grain— 35 per cent by weight.
Weight of seed—1,000 seeds weigh 3·14 grammes.
Number of seeds in 1 lb.—144,450.
Yield—400 to 500 lb. of grain and 2,000 lb. of straw per acre.

KODO MILLET.

(*Paspalum Scrobiculatum.*)

Tamil	Varagu.
Telugu	Arikelu.
Kanarese	Arikel.
Oriya	Khoddi.

Area in Madras—1,721,800 acres.

Commonly grown dry on poor soils often mixed with red gram (sown in lines 4 feet to 5 feet apart) and seldom manured. Occasionally heavy yields are obtained from alluvial or deep black soils. A very hardy cereal which can be grown on any soil. The grain can be kept good for many years and hence it is a useful famine reserve, though the food and fodder are both inferior. The straw is used as manure for salt lands.

Seed-rate—12 to 20 lb.

Volume weight—1 M.M. weighs 2·76 lb.

Husk to grain—40 per cent by weight.

Weight of seeds—1,000 seeds weigh 5·90 grammes.

Number of seeds in 1 lb.—76,900.

Yield—600 to 900 lb. of grain and 1,000 to 2.000 lb. of straw.

WHEAT.

(*Triticum* Sp.)

Tamil	Godumai.
Telugu	Godumalu.
Malayalam	Kotampam.
Kanarese	Godi.
Tulu	Godi.

Area in Madras—18,300 acres.

Wheat is not an important crop. According to Howard the Madras wheats fall under three heads, viz. *Triticum vulgare*, *T. Durum* and *T. Dicoccum* (*Emmer*). Some of the dry wheats of the northern parts of the Deccan and Akkigodi of Nilgiris fall under the first two varieties, whereas the irrigated wheat of Coimbatore is *Dicoccum*. This last does not thresh out clean, i.e., the "seed" is really the spikelet containing two (sometimes three) grains.

Seed-rate—25 lb. (in 1 and 2) ; 60 to 70 lb. in *Dicoccum*.

Weight of seed—1,000 seeds weigh 30·6 grammes (*Dicoccum*).

Number of seeds in 1 lb.—14,800.

Germination capacity—61 to 91 per cent in ten days.
Yield—The irrigated crop will yield 1,500 lb. to 1,700 lb. Dry Crop 400 to 800 lb.

MAIZE.

(*Zea Mays.*)

Tamil	Makka Cholam, Thulukka Cholam.
Telugu	Mokka Jonnalu.
Malayalam	Makka Cholam.
Kanarese	Mekke Jola.
Oriya	Mokka.
Tulu	Jola.

Area in Madras—133,900 acres.
Introduced varieties are occasionally met with. It is cultivated on a very limited scale as a field crop: as for instance in the Kistna delta on lands too high for irrigation. It is sown also in small patches to supply green cobs. It may also be grown for fodder.
Seed-rate—6 to 8 lb.; for fodder 20 lb.
Volume weight—1 M.M. weighs 3 lb.
Weight of grain—100 seeds weigh 30·4 grammes.
Number of seeds in 1 lb.—1,500.
Germination capacity—80 per cent.
Yield—Very variable: a good dry crop should give 1,200 to 1,500 lb.; 4,000 to 8,000 cobs.

PULSES.

BENGAL GRAM.

(*Cicer Arietinum.*)

Tamil	Kadalai.
Telugu	Sanagalu.
Malayalam	Kadalakka.
Kanarese	Kadale.
Oriya	Sullo Chonna.
Tulu	Kadale.

Area in Madras—138,400 acres.
Varieties are known with white, pale yellow, dark yellow or black grains. The crop is practically confined to the black soils. It is a late crop, sown after the rains. It is generally sown by itself, drilled or dibbled behind the plough, but may somtimes be broadcasted in mixtures.

Seed-rate—40 to 70 lb. per acre.
Volume weight—1 M.M. weighs 3·13 lb.
Husk to grain—20 per cent by weight.
Weight of seed—1,000 seeds weigh 133·94 grammes.
Number of seeds in 1 lb.—3,400.
Germination capacity—98 per cent.
Yield—300 to 700 lb. The refuse is a useful cattle food.

RED GRAM.

(*Cajanus Indicus.*)

Tamil	Tuvarai.
Telugu	Kandulu.
Malayalam	Tuvera.
Kanarese	Togari.
Oriya	Kandulo.
Tulu	Togori.

Area in Madras—294,800 acres.

There are numerous varieties which differ in the colour of their seed coats. A very widespread and hardy pulse ; sown early ; stops seven to nine months in the field. Practically always grown as a mixture, frequently in lines 4 feet to 6 feet apart with cereals. Dhal is a very valuable and important human food, while the husk is a good cattle food.

Seed-rate will vary with the mixture adopted : from 2 to 4 lb. per acre.

Volume weight—1 M.M. weighs 2·83 lb.
Husk to grain—20 per cent.
Weight of seed—1,000 seeds weigh 8·95 grammes.
Number of seeds in 1 lb.—6,600.
Germination capacity—76 per cent.
Yield—This will vary very much with the class of mixture ; 300 to 1,000 lb. per acre. The refuse (pods, leaves, etc.) obtained in the process of threshing is stacked and given to working cattle.

HORSE GRAM.

(*Dolichos biflorus.*)

Tamil	Kollu or Kanam.
Telugu	Ulavalu.
Malayalam	Muthira.
Kanarese	Huruli.
Oriya	Kalutho.
Tulu	Kudu.

Area in Madras—2,208,000 acres.

There are varieties with black, grey or mottled seeds of various shades. The crop is sown pure on the poorest and thinnest red soils. It is found as a mixture with cotton in Nandyal and Tinnevelly. The grain is used for feeding cattle and horses, and is also eaten by man, it is a good fodder and green manure crop. The black variety is of short duration and is therefore sown late.

Seed-rate—15 to 20 lb. ; in the case of black horse gram it is 30 to 40 lb. Half the seed-rate or less if the seed is mixed. For fodder crop from 30 to 50 lb. per acre.

Volume weight—1 M.M. weighs 3·45 lb.

Weight of seed—1,000 seeds weigh 29·25 grammes.

Number of seeds in 1 lb.—15,500.

Germination capacity—90 per cent.

Yield—100 to 200 lb. in a mixture and 300 to 400 lb. if sown alone ; 500 lb. of dry fodder, including pods, etc.

FIELD BEAN.

(*Dolichos Lablab.*)

Tamil	Mochai.
Telugu	Anumulu.
Kanarese	Avarai.
Malayalam	Moccakotta.
Oriya	Bairo.
Tulu	Abare.

The seeds vary in colour from a dark red approaching black to a light cream almost white. Flowers white, occasionally purple.

It is a climbing plant which is always grown as a mixture, generally with some upstanding cereal like sorghum or kambu sown early in lines. A pure crop may be used to check weeds (smother crop).

Seed-rate—For a pure crop about 30 lb. would be needed. In mixtures 7 to 14 may be sown.

Volume weight—1 M.M. weighs 3·33 lb.

Husk to grain—21 per cent by weight.

Weight of seed—1,000 seeds weigh 256·94 grammes.

Number of seeds in 1 lb.—1,765.

Germination capacity—89 per cent.

Yield—100 to 200 lb. in a mixture ; 300 to 400 if sown alone.

GREEN GRAM.

(*Phaseolus Mungo.*)

Tamil	Paççapagaru.
Telugu	Pesalu, Paççapesalu.
Malayalam	Cherupayaru.
Kanarese	Hasaru.
Oriya	Puggo.
Tulu	Madenji.

Area in Madras—386,000 acres.

There are three varieties characterized by having green, yellow and black seeds. The crop is commonly grown throughout the Presidency, generally as a subsidiary crop to one of the cereals. It may be grown as a second crop on rice land or sown thick as a smother crop for weeds on irrigated land. The grain is held in high esteem.

Seed-rate—Up to 5 lb. in a mixture.
Volume weight—1 M.M. weighs 3·43 lb.
Husk to grain—24 per cent by weight.
Weight of seed—1,000 seeds weigh 29·22 grammes.
Number of seeds in 1 lb.—15,500.
Germination capacity—91 per cent.
Yield—150 to 200 lb. in a mixture.

BLACK GRAM.

(*Phaseolus Mungo* var. *Radiatus*, Hook.)

Tamil	Ulundu.
Telugu	Minumulu.
Malayalam	Uzhunnu.
Kanarese	Uddu.
Tulu	Urdu.

Area in Madras—160,200 acres.

The remarks under previous crop, which it closely resembles in appearance, yield and methods of cultivation, hold good. This suits a stiff soil.

Seed-rate—Up to 5·lb. in a mixture.
Volume weight—1 M.M. weighs 3·3 lb.
Husk to grain—11 per cent by weight.
Weight of seed—1,000 seeds weigh 46·3 grammes.
Number of seeds in 1 lb.—9,800.
Germination capacity—98 per cent.

DEW GRAM.

(*Phaseolus aconitifolius.*)

Tamil	... ...	Naripayaru, Kallupayaru, Tullikkapayaru.
Telugu	... ...	Mittikelu.

There is only one variety ; which is rather sparingly cultivated in Madras ; it is a poor yielder, and is found generally as a mixture on the least fertile lands. The whole plant is a valuable fodder and is frequently grown, either alone or mixed with some millet, for this purpose exclusively. It may also be grown as a green manure crop.

Seed-rate—1½ to 3 lb. per acre in mixture.
Volume weight—1 M.M. weighs 2·66 lb.
Weight of seed—1,000 seeds weigh 16·67 grammes.
Number of seeds in 1 lb.—27,200.
Germination capacity—91 per cent.
Yield—120 to 150 lb. in a mixture.

COW GRAM : COW PEA.

(*Vigna Catiang.*)

Tamil	... ...	Karamani, Tattapayaru.
Telugu	... ...	Alasandulu, Bobbarlu.
Malayalam	...	Mampayaru, Kottapayaru.
Kanarese	... ...	Avade.
Oriya	.. ....	Mamkododandi.
Tulu	... ..	Lattane, Alasande.

A fairly common pulse as a mixed crop. The pods are prominent and large. A very useful green manure crop. It makes an excellent combination for cattle food when grown with cholam fodder.

Seed-rate—15 to 20 lb. as a pure crop. Half this for mixtures.
Volume weight—1 M.M. weighs 3·1 lb.
Husk to grain—10 per cent by weight.
Weight of seed—1,000 seeds weigh 128·2 grammes.
Number of seeds in 1 lb.—3,530.
Germination capacity—95 to 100 per cent.
Yield—300 to 400 lb. per acre in a pure crop.

VEGETABLES AND GARDEN PRODUCE.

BRINJAL.

(*Solanum melongena.*)

Tamil	Kathri.
Telugu	Vankaya.
Malayalam	Vazhuthininga.
Kanarese	Badinekayi.
Oriya	Banjino.
Tulu	Badane.

There are many local varieties which differ in colour, shape, size and flavour. Introduced varieties from American seed have been tried but have not spread. The crop is grown all over the Presidency on garden lands, sometimes alone, but more often mixed with various vegetables or at the edges of betel gardens. The unripe fruits are used for making curries.

Seed-rate.—The crop is grown from transplanted seedlings. Between one and two pounds of seed sown in three-fourths of a cent, will plant one acre two feet apart both ways.

Yield—up to 20,000 lb. per acre for a good crop.

CLUSTER BEAN.

(*Cyamopsis psoralioides.*)

Tamil	Kottavarai.
Telugu	Goruchikkudikaya.
Kanarese	Govardhanakayi.

The crop is of very little importance and is confined to mixtures in vegetable gardens. It is nowhere grown on a field scale.

PUMPKIN.

(*Cucurbita maxima.*)

Tamil	Pushinikkai : Parangikkai : Sakkarai Pushinikkai.
Telugu	Gummadikaya.
Malayalam	Mattanga.
Tulu	Kumbuda : Kembude : Kancholu.

There are several varieties differing in shape, size and colour of fruits. There are also varieties which are sown in summer and in the rains. It is chiefly a rainy weather crop. The ripe and unripe fruits are used as vegetables for making curries. The ripe fruits keep for months. It is usually grown near the hedges in field margins : but occasionally may be found as a field crop.

CUCUMBER.

(*Cucumis Sativus.*)

Tamil	Velliri.
Telugu	Dosakaya.
Kanarese	Sonthikayi.
Tulu	Tante.

There are many local varieties which differ in colour, shape, size, flavour and keeping quality of the fruit. The crop is commonly grown mixed with all crops in black soils of Kistna district. It is also grown in tank beds when tanks get dry in the beginning of summer. It is very common on the West Coast. Near Madras occasionally on a field scale.

The fruits are eaten fresh or cooked. The variety cultivated in Kistna district can be dried and preserved, and is often used in making pickles.

MELON.

(*Cucumis Melo.*)

Tamil	Mulampazham : Karbujapazham.
Telugu	Karbuja pandu.
Malayalam	...
Kanarese	Karbuja hannu.
Tulu	Tekkarpe : Tekkare.

There are a number of melons grown in tank beds or in the sandy beds of rivers, in the hot weather, many of which have local reputation, e.g., Cuddapah melons, Siddhout melons. They are generally heavily manured and hand-watered.

VEGETABLE MARROW.

(*Cucurbita Pepo.*)

Tamil ... ... Simapushini or Simaparangi.

There are several varieties differing in size and shape of the fruit. Occasionally met with in vegetable gardens.

MUSK MELON.

(*Cucurbita Moschata.*)

Tamil ... ... Arasanikai.

This variety is found in the Coimbatore district.

WATER MELON.

(*Citrullus Vulgaris.*)

Tamil	Piçça pazham : Karbuja.
Telugu	Kalangadi pandu : Puçça pandu.
Kanarese	Baççangayi.
Tulu	Baççangayi.

A large green water melon with dark mottled green skin and pinkish flesh with black seeds.

The ripe fruits are sold in the hot weather in the bazaars.

LADIES' FINGERS.

(*Hibiscus esculentus.*)

Tamil	Vendaikay.
Telugu	Bendakaya.
Kanarese	Bendakayi.
Tulu	Bendekayi: Bendayi.

This is grown as a small percentage in a mixture in vegetable and other gardens for the sake of its unripe fruits. It is nowhere very extensively grown, though found all over the Presidency, especially near large towns. It has been recommended as a "trap crop" for cotton pests.

Seed-rate—5 to 10 lb. when the crop is to be transplanted.

SWEET-POTATO.

(*Ipomœa Batatas.*)

Tamil	Sakkaraivallikizhangu or Chinikizhangu.
Telugu	Genusugaddalu.
Malayalam	Chakkarai kizhangu.
Kanarese	Genusu.
Oriya	Kondamulo.
Tulu	Kerang.

A white skinned and a red skinned variety are known.

The crop is grown extensively throughout Madras as a garden crop, preferably on deep sandy soils. The mature vines are cut into lengths with generally three nodes, and planted on ridges or flat beds. Care must be taken to see that the spreading plants do not root at the nodes. It is commonly used as food, either cooked in curry or boiled, roasted or fried. The vines are good cattle food.

Seed-rate—20,000 to 35,000 sets per acre.

Yield—8,000 to 12,000 lb. per acre.

TAPIOCA.

(*Manihot utilissima.*)

Tamil	Maravallikizhangu.
Telugu	Karra pendalam.
Malayalam	Marachini.

The crop is grown fairly widely from cuttings in the sandy soils of South Arcot, Chingleput and Nellore, and occasionally further north along the littoral tracts. It is grown largely on the West Coast. In South Arcot a good crop weighed fresh 13,000 lb. an acre.

ELEPHANT YAM.

(*Amorphophallus campanulatus.*)

Tamil	Karakkaranai : Shenaikizhangu.
Telugu	Thiyyakanda.
Malayalam	Senai.

On the West Coast, this is cultivated on dry land often mixed with ginger as a rain-fed crop ; also in the compounds of houses where it may receive occasional irrigation. In Coimbatore, it forms a subordinate crop in turmeric.

Seed-rate—About 1,500 lb. of corms per acre.

Yield—About 15,000 lb. per acre.

DIOSCOREA.

The true yam is grown occasionally in betel gardens, etc. It is fairly common on the West Coast.

COLOCASIA.

(*Colocasia antiquorum.*)

Tamil	Sheppankizhangu or Shamakkizhangu.
Telugu	Shamagadda.
Malayalam	Chempakizhangu.
Kanarese	Chamagadda.
Tulu	Tevu.

There is a variety without acridity occurring rarely in Malabar. The area under this crop is limited and it is confined to rich garden lands and backyards, with the exception of the West Coast, where it may be grown as a dry crop. In Chingleput, this occurs as a pure crop on good sandy loams, where it is heavily manured with cattle manure and copiously watered. In Tanjore it is grown as a field crop, either pure

or mixed with yams and other vegetables. It is grown in trenches or pits and needs heavy manuring, when it is most profitable returning up to forty-fold. The corms are cooked and made into curry. Red soil is said in Chingleput to produce round tubers.

Seed-rate—600 lb. of corms.
Yield—8,000 to 10,000 lb.

TYPHONIUM TRILOBATUM.

Tamil	Karanai kizhangu.
Telugu	Kanda.
Oriya	Ullo.
Tulu	Kene.

This is cultivated in small quantities in Chingleput and Chittoor. The root is acrid. The acridity is removed by boiling the root with tamarind water. It has a reputation as a remedy for piles.

Seed-rate—500 to 600 lb. per acre.

ARROW-ROOT.

(*Curcuma angustifolia.*)

Tamil	Araruttu.
Telugu	Palagunpa.
Malayalam	Kuvva.
Kanarese	Kuvegida.
Oriya	Palu.
Tulu	Kooveda dayi.

The cultivation is very limited and the crop is found only in Ganjām, parts of the Circars and the West Coast. It is grown on well-manured sandy soils.

Seed-rate—About 700 lb. per acre.
Yield—4,000 to 8,000 lb. of tubers. 100 lb. of tubers produce about 12½ lb. of flour.

POTATO.

(*Solanum tuberosum.*)

Tamil	Urulaikkizhangu.
Telugu	Urula gadda.
Malayalam	Urula kizhangu.
Kanarese	Urula gadda.
Tulu	Batate.

The varieties are numerous. The crop is confined to the hills, since the temperature of the plains is too high for it to be grown profitably. It is an increasingly important crop on the Nilgiris.

Seed-rate—900 to 1,000 lb. per acre.
Yield—5 to 6 tons.

CEPHALANDRA INDICA.

Tamil	Kovai.
Telugu	Dondai.

There are two varieties, one is wild and is bitter, and the other cultivated which is sweet. It is said that the fruits lose bitterness under cultivation. In the Circars, it is cultivated and the fruit is used as a vegetable. Elsewhere it is commonly found wild, growing on bushes and hedges. The ripe fruit may be gathered as it becomes sweet.

AMARANTH.

(*Amaranthus gangeticus.*)

Tamil	Kiraithandu.
Telugu	Thotakoora.
Malayalam	
Kanarese	

This is grown as a mixed crop in vegetable and backyard gardens. The whole plant is generally pulled out and sold.

There is another variety which goes by the name *A. Paniculatus*, and which is grown on the hills for the sake of its grain which is parched and made into flour and eaten. It is also used for making sweetmeats.

Weight of seed—1,000 seeds weigh ·82 gramme.
Number of seeds in 1 lb.—553,000.

SNAKE GOURD.

(*Trichosanthes anguina.*)

Tamil	Pudalangai.
Telugu	Potlakaya.
Malayalam	Padavalanga.

This gourd is cultivated commonly throughout India as a rainy season crop in back yards and occasionally on garden lands. There are varieties differing in the size of the fruit and its colour : length, 5 feet to 2 feet : colour from light to

dark green, occasionally with lighter stripes. The ripe fruit is deep orange in colour externally and the pulp inside in which the seeds are imbedded is scarlet. This fruit is largely used as a vegetable especially when tender and unripe.

BITTER-GOURD OR CARILLA FRUIT.

(*Momordica charantia.*)

Tamil	...	Pavakkai.
Telugu	...	Kakarakaya.
Malayalam	...	Kaippakka.

The fruits are slightly bitter and are largely used in making curries. There are several cultivated forms which differ in size and colour of the fruit: some forms have long warty fruits varying in length from 4 inches to 12 inches while others produce small fruits varying from ½ to 1 inch. Colour varies from light to dark green. The fruit is supposed to be a good tonic and stomachic.

CALABASH OR CALABASH-CUCUMBER.

(*Lagenaria vulgaris.*)

Tamil	...	Sorakkai.
Telugu	...	Sorakaya.
Malayalam	...	Churaka.

An exotic but now largely cultivated in India. Unlike the other gourds this has white flowers. The unripe fruits, just before the outer skin becomes thick, form a good vegetable if seasoned. When fully ripe the rind of the fruit becomes very hard and woody and then it makes an excellent vessel or flask.

ASH-GOURD OR ASH-PUMPKIN.

(*Benincasa cerifera.*)

Tamil	...	Kalyana pushini.
Telugu	...	Budutha gummidi or Pendli gummidi.
Malayalam	...	Kumbalam.

This is another gourd very widely cultivated all over India. The fruits are usually large (1 to 1½ feet long), up to 25 lb. in weight, smooth but covered with whitish bloom.

When fully ripe the rind becomes hard and the fruits keep well for a long time.

RIBBED-GOURD.

(*Luffa acutangula.*)

Tamil	...	...	...	...	Peerkan.
Telugu	...	...	...	...	Beera.

The fruit is very largely used in curries, when it is about half-mature and it is considered to be one of the best of the indigenous vegetable plants. The fruits grow to about one foot and have sharp ridges externally. It is cultivated all over India.

LOOFAH.

(*Luffa aegyptiaca.*)

Tamil	...	...	...	...	Norai Peerkan.
Telugu	...	...	...	...	Gutti beera or Nuna beera.

Though not a native of India, it is widely cultivated and has become naturalized. This differs from the ribbed-gourd in not having the sharp ridges, but in other respects both are similar. The net work of vascular bundles forming the frame work of the pericarp in the fruits of this and the ribbed-gourd forms the loofah of commerce.

GUINEA GRASS.

(*Panicum maximum.*)

A fodder crop which has been introduced successfully in parts of Madras. The crop is usually propagated by portions separated from the root stocks, which become overgrown and need division. The roots should be set out evenly in rows running in both directions spaced 3′ × 3′ or 2′ × 2′ to ensure through inter-cultivation. The plant needs copious irrigation and liberal manuring; it is quick growing and ordinarily eight cuttings can be had in a year. 500 slips weigh 40 lb. and fill one gunny bag.

Yield—25,000 to 40,000 lb. of green fodder per acre per annum in 8 cuttings.

LUCERNE.

(*Medicago sativa.*)

An excellent fodder, but difficult to grow extensively. Has yielded at Coimbatore 15,000 lb. an acre in a year.

OIL SEEDS.

GINGELLY.

(*Sesamum indicum.*)

Tamil	Ellu.
Telugu	Nuvvulu.
Malayalam	Ellu.
Kanarese	Yellu.
Oriya	Rasi.
Tulu	Yenme.

Area in Madras—812,800 acres.

There are several local varieties which differ in their period of growth, time of sowing and the colour of their seed. The crop is grown throughout the Presidency generally as an early crop. It is seen on the driest and poorest soils, on the richest delta lands and on paddy fields as a second crop. Owing to the small size of the seed it is sometimes difficult to get a full plant.

Seed-rate—2 to 3 lb.; less if drilled.

Volume weight—1 M.M. weighs 2·57 lb.

Weight of seed—1,000 seeds weigh 2·61 grammes.

Number of seeds in 1 lb.—172,800.

Germination capacity—90 per cent.

Yield—350 to 450 lb.; but of course this will vary very much according to the conditions under which it is grown.

Percentage of oil—40 per cent by weight.

CASTOR.

(*Ricinus communis.*)

Tamil	Amanakku : Kottai-muthu.
Telugu	Amudalu.
Malayalam	Avanakku.
Kanarese	Haralu.
Oriya	Kallo.
Tulu	Almbudathakayi.

Area in Madras—454,900 acres.

There are numerous varieties, annual, biennial and perennial, grown either as garden or dry crops, and either green or red in colour. As a dry crop, castor occupies the poorest red soil, alone or mixed with one of the inferior millets or grams. As a perennial, it is dibbled along the

edges of sugarcane and betel vine and other garden crops. It is generally sown in fields in lines.

Seed-rate—10 to 20 lb. per acre.

Volume weight—1 M.M. weighs 2·87 lb.

Weight of seed—1,000 seeds weigh 346·71 grammes.

Number of seeds in 1 lb.—1,308.

Germination capacity—80 per cent.

Yield—200 to 300 lb. as dry crop in poor lands, up to 700 lb. in more favourable surroundings.

Percentage of oil—46, but ordinary extraction gives 36. The cake is an excellent manure.

GROUNDNUT.

(*Arachis hypogea.*)

Tamil	Verkadalai : Nilakkadalai.
Telugu	Vershanagalu : Nelashanagalu.
Kanarese	Nilakkadala.
Tulu	Nilakkadale.

Area in Madras—1,455,800 acres.

The Mauritius variety has practically displaced the old local variety ; other varieties may be seen on trial at the Palur Agricultural station.

The crop suits sandy soils, and is either sown as a dry rain-fed crop, when it is mixed with some cereal, or raised under irrigation mixed with ragi.

Rain-fed crop :--June-July to December-January. Irrigated crop : February-March to July-August. The crop is very profitable, and its area has increased rapidly in the last few years.

Seed-rate—50 to 75 lb. good shelled seed.

Volume weight—1 Madras measure of unshelled nuts weighs 1¾ lb. 1 Madras measure of shelled nuts weighs 2½ lb. 1 Madras measure of oil is 3½ lb.

Weight of seed—100 seeds weigh 43 grammes.

Number of seeds in 1 lb.—1,000.

Yield—Dry average 1,300 lb. per acre. Irrigated crop as much as 2,500 lb.

Percentage of oil—As extracted by country mill is 36 to 40, actual contents up to 50 per cent.

Proportion of shell to kernels—25 per cent by weight, being a little higher in the case of dry rain-fed crop.

NIGER SEED.

(*Guizotia abyssinica.*)

Tamil	Peyellu : Uchchellu.
Telugu	Verrinuvvulu : Valiselu : Ojurellu.
Kanarese	Huchellu.

A black oil seed grown occasionally as a mixture in the western and northern taluks of Bellary, and in the uplands of the Circars, Salem, Coimbatore, etc.

Seed-rate—About one pound of seed is mixed with a cereal.

Weight of seed—1,000 seeds weigh 4·55 grammes.

Number of seeds in 1 lb.—100,000.

Yield—About 300 lb. may be expected from an acre.

Percentage of oil—35 by extraction.

LINSEED.

(*Linum usitatissimum.*)

Tamil	Alivirai.
Telugu	Avisi.
Kanarese	Alasi.

Area in Madras—25,000 acres.

This is only grown for its seed, which yields a valuable oil : the fibre is not extracted. The crop is found mostly in the Bellary portion of the Deccan upland, mixed with other crops like safflower or wheat.

Seed-rate—15 to 20 lb. per acre.

Volume weight—1 M.M. weighs 2·87 lb.

Weight of seed—100 seeds weigh 6·4 grammes.

Number of seeds in 1 lb.—70,900.

Yield—300 to 400 lb. of seed per acre.

Percentage of oil—about 30 when pressed in the ordinary country mills.

SAFFLOWER.

(*Carthamus tinctorius.*)

Tamil	Kasumbavirai.
Telugu	Kusumbalu.
Kanarese	Kusumba.
Tulu	Kusumadapu.

The plant may be grown both for its oil and also for the dye which can be extracted from the flowers, though there is little or no extraction done now in Madras. The foliage of the plants ordinarily met with is thickly armed with spines. There is also a smooth-leaved variety. The cultivation is confined to the black soils of the Ceded Districts, where it is frequently seen sown on the head-lands, partly to prevent cattle trespass, and partly because it can be sown late. The oil is very clear and is used in cooking; also to adulterate ghee.

Seed-rate—5 to 10 lb.

Volume weight—1 M.M. weighs 2·43 lb.

Weight of seed—1,000 seeds weigh 41·27 grammes.

Number of seeds in 1 lb.—11,000.

Yield—400 lb. per acre.

Percentage of oil—30; ordinary methods extract 20 per cent. The cake is used as a cattle food and is said not to get mouldy readily.

FIBRES.

COTTON.

(*Gossypium herbaceum; Gossypium indicum; Gossypium obtusifolium; Gossypium hirsutum.*)

Tamil	Paruthī.
Telugu	Parthi.
Malayalam	Parutti.
Kanarese	Hatti.
Oriya	Koppa.
Tulu	Parti.

Area in Madras—2,018,900 acres.

The two common varieties grown as annuals on the black cotton soils are *G. herbaceum* (Tellapathi; Uppam; Ukkam) and *G. indicum* (Yerrapathi; Karunganni). Besides these, *G. obtusifolium* (Nadam) is found in parts of Coimbatore, while in the same tract are found the remains of the early introduction of American cotton in the shape of *G. hirsutum* (Bourbon); both these are perennial.

All the above are dry crops and occupy generally the black cotton soils, though Yerrapathi is found on reddish soils, and the two last are found on lightish gravelly soils.

Seed-rate—5 to 15 lb. per acre; rate varies in different Localities and also with the soils.

Volume weight—(Uppam) 1 M.M. weighs 2·1 lb.
Weight of seed—(Uppam) 1,000 seeds weigh 49·2 grammes.
Number of seeds in 1 lb.—(Uppam) 9,220.
Yield—300 to 450 lb. Nadam 300 lb. a year for 2½ years.
Ginning percentage—22 per cent up to 26 per cent. In selected strains up to 33 per cent.

CAMBODIA COTTON.

(*Gossypium hirsutum.*)

This is a recently introduced cotton which has spread from the south, and now occupies a very considerable area. It should be grown normally as an irrigated crop, and will repay good treatment. Very good samples of Kappas may be obtained from the soils at the foot of the hills, as in Madura district, but Cambodia does not take kindly to black soils. Seed is sown at the beginning of the north-east monsoon.
Seed-rate—10 to 20 lb.
Germination capacity—90 per cent.
Yield—700 to 1,500 lb. per acre : cases have been reported where the yield has been over 2,000 lb.
Ginning percentage—30 to 33 per cent.

DECCAN HEMP : BIMLIPATAM JUTE.

(*Hibiscus cannabinus.*)

Tamil	...	...	Pulicchai or Pulimanji.
Telugu	...	...	Gogu.
Kanarese	...	...	Pundi.

Area in Madras—66,200 acres.
There are several varieties distinguished by the colour of the stem and leaf which is either green or wholly or partly red. The shape of the leaves also varies being either entire or palmately divided. The crop is grown very commonly as a slight mixture in almost any crop, the leaf being used for curry. As a pure crop, its cultivation is confined to parts of Guntūr and Vizagapatam. Tests at Coimbatore have shown that there the red stemmed green veined variety with divided leaves is the best for fibre.
Seed-rate—25 to 30 lb. per acre.
Volume weight—1 M.M. weighs 2·63 lb.
Weight of seed—1,000 seeds weigh 24·5 grammes.

Number of seeds in 1 lb.—18,500.
Yield—600 to 1,000 lb. dry fibre.
Percentage of fibre to dry stalks—16 to 17.
Percentage of fibre to green stalks—4.

SUNNHEMP.

(*Crotolaria juncea.*)

Tamil	Sanappu or Shanal.
Telugu	Janumu.
Malayalam	Wuckoo.
Kanarese	Sonabu.
Oriya	Soin.
Tulu	Talambu.

Area in Madras—216,400 acres.

The crop is found very extensively as a mixture throughout the uplands of Kistna and Guntūr and pure as a second crop after paddy in the deltas. It is grown as a pure crop in parts of Gōdāvari, Tinnevelly and Chingleput. Its use as a green manure crop is rapidly extending, and has caused a heavy demand for seed. The fibre is used for making gunny bags, tails of mhote buckets, harness of pack bullocks, etc. Fishing nets in coastal tracts are exclusively made of this.

Seed-rate—40 to 60 lb. up to 100 to 150 lb. in places.
Volume weight—1 M.M. weighs 3·12 lb.
Weight of seed—1,000 seeds weigh 46·4 grammes.
Number of seeds in 1 lb.—9,800.
Yield—500 to 800 lb. of fibre; grown as a seed crop 400 to 600 lb. of seed may be expected.
Percentage of fibre to dry stem—8·2 per cent.

AGAVE.

(*Agave vera Cruz: Agave sisalana.*)

Tamil	Anaikkattazhai, Kattazhai.
Telugu	Kalabanda.
Malayalam	Wakkuchan.

The American or Railway aloe (misnamed) is commonly seen in all parts of the Presidency as a hedge plant. It is generally propagated by means of plantlets which arise as suckers on the roots of the older plant, or by bulbils.

Attempts have been made to grow the sisal agave on a large scale but without much success. It can only pay when rents

are low; on such lands, difficulties are often felt in the extraction of the fibre for want of water. The fibre is excellent.

Yield—Each plant will produce 15—20 leaves a year. The average weight of each leaf being 6 lb., 900 plants per acre will give at this rate and with 3½ per cent fibre, 300 lb. of dry fibre per acre per annum.

CONDIMENTS AND SPICES.

CHILLIES.

(*Capsicum annuum, Watt.*)

Tamil	Milagai.
Telugu	Mirapakaya.
Malayalam	Molaku.
Kanarese	Menasinakayi.
Oriya	Lonkamonho.
Tulu	Munuchi.

Area in Madras—286,000 acres.

There is one common variety, though special races from particular districts are recognized for their good qualities. The plant is generally transplanted from a seed bed, and is usually grown on garden lands, as a pure crop or as a mixture in a vegetable garden. On dry soils it is an important crop in Guntūr and the uplands in the Gōdāvari and Kistna, where it is grown in large fields which are most accurately transplanted to allow of careful inter-cultivation. The pods are picked and dried for marketing.

Seed-rate—1 to 1½ lb. to transplant an acre.

Volume weight—1 Madras measure of dried fruits weighs ½ lb.

Weight of seed—1,000 seeds weigh 5·65 grammes.

Number of seeds in 1 lb.—80,300.

Yield—2,000 to 2,500 lb.

ONIONS.

(*Allium cepa.*)

Tamil	Vengayam, Irulli.
Telugu	Ulligadda, Nirulli.
Malayalam	Chuvannaulli.
Kanarese	Irulli, Ulligadda.
Oriya	Pizago.
Tulu	Neerulli.

The common onion grown in Madras is of a reddish colour. It is raised from seed which is sown in a seed-bed ; the seedlings being planted out in beds or ridges, or is raised from bulbs which are planted preferably on ridges. The latter method is obviously wasteful. White onions from Dhulia in Bombay have been grown successfully. The Bellary onion has a special reputation.

Seed-rate—10 lb. carefully sown in a nursery will be enough for an acre. The seed is delicate and must be fresh as it very quickly deteriorates. For bulb planting about 1,000 lb. will be sufficient to plant an acre.

Volume weight—1 Madras measure of seed weighs 2 lb.

Weight of seed—1,000 seeds weigh 3·95 grammes.

Number of seeds in 1 lb.—114,800.

Yield—15,000 to 25,000 lb. per acre. About 15 to 25 per cent of dryage will occur on storing for three months. Onions are rarely kept for more than three or four months, either for consumption or for planting.

GARLIC.

(*Allium sativum.*)

Tamil	Vellaipundu.
Telugu	Tellagadda : Velluli.
Malayalam	Vellulli.
Kanarese	Bellulli.
Oriya	Losono.
Tulu	Bolluli.

A rare field crop which is only occasionally seen. It is raised from bulbs. The treatment is similar to that outlined for onions. As a food, garlic is almost universally used in curries on account of its varied medicinal properties. It is a more valuable crop than onion and can be kept much longer.

Seed-rate—500 to 700 lb. of bulbs will be sufficient to plant an acre.

Yield—8,000 to 10,000 lb. per acre.

TURMERIC.

(*Curcuma longa.*)

Tamil	Manjal.
Telugu	Pasupu.
Malayalam	Manjal.
Kanarese	Arashina.
Oriya	Holodi.
Tulu	Manjal.

Area in Madras—54,400 acres.

There are no distinct varieties though the rhizomes from different localities show slight differences.

An irrigated crop grown in wet or garden lands; needing a deep fertile, well-drained soil; occupies the ground for nine months. It is usually planted in rows by hand on ridges; and generally mixed with yams, castor, etc. Castor gives the necessary shade and supplies some fuel for curing.

Seed-rate—1,000 to 1,700 lb. per acre.

Yield—12,000 to 20,000 lb. of green roots which when cured and dried will weigh 3,000 to 5,000 lb. approximately.

CORIANDER.

(*Coriandrum sativum.*)

Tamil	Kottumalli.
Telugu	Dhaniyalu or Kottumeri.
Malayalam	Kottumpalari.
Kanarese	Kothumbaribija.
Oriya	Dhonia.
Tulu	Kottemberi.

Area in Madras—105,000 acres.

There is only one variety, which is grown on a field scale principally on black soils, and as a mixture with cotton and other crops. In deep and heavy black soils, in parts of Tinnevelly district, this is grown pure in extensive fields where it rotates with kambu and gives heavy yields. Occasionally grown in gardens for seed, and also as a vegetable for the sake of the leaves.

Seed-rate—10 to 12 lb. for a pure crop; 2 to 4 lb. in mixtures.

Weight of seeds—1,000 mericarps (i.e., 500 fruits) weigh 7·31 grammes.

Number of seeds in 1 lb.—62,000.

Yield—about 350 lb. per acre.

CUMMIN.

(*Cuminum cyminum.*)

Tamil	Siragam.
Telugu	Jilakara.
Malayalam	Jirakam.
Kanarese	Jirige.
Tulu	Jerridari.

This is a valuable and delicate crop raised in gardens : it requires much care, fine tilth and a firm seed-bed : grown in two seasons, beginning of south-west and end of north-east monsoons : wants thorough manuring and light watering and mild climate. Hence cultivated in limited extent in Coimbatore and elsewhere in Madura and in Cuddapah-Kurnool. A rich loam fairly well-drained is preferred : two months crop.

Seed-rate – 20 lb. per acre.
Weight of seed—1,000 seeds weigh 3·97 grammes.
Number of seeds in 1 lb.—114,250.
Yield—up to 750 lb. of seed (fruits).

OMUM—BISHOP'S WEED.

(*Carum copticum.*)

Tamil	Ashamadhan: Omum.
Telugu	Omu : Omamu.
Kanarese	Omu.
Malayalam	Ayamodakam.

A crop of very minor importance agriculturally. Grown occasionally as a field crop in parts of the Nandyal valley and as a mixture on black cotton soils in Tinnevelly.

MUSTARD.

(*Brassica juncea.*)

Tamil	Kadugu.
Telugu	Avalu.
Malayalam	Katuku.
Kanarese	Sasive.
Oriya	Soriso.
Tulu	Dasemi.

The area under this crop is small. It is found in parts of Salem and Coimbatore uplands, and as a cold weather crop in Ganjām and on the Kistna lankas. It is always grown as a mixture.

Seed-rate—4 to 6 lb.
Weight of seed—1,000 seeds weigh 1·78 grammes.
Number of seeds in 1 lb.—254,800.
Yield—400 lb.

PEPPER.

(*Piper nigrum.*)

Tamil	Milagu.
Telugu	Miriyalu.
Malayalam	Kurumulaku.
Kanarese	Olleminasu.
Tulu	Sedde Munuchi.

The following varieties are grown : Balamcotta, Kalluvalli and Cheriya Kodi. An inferior female variety (others are all hermaphrodite) called Utherankotta is often seen in gardens. The crop is confined to the West Coast, mostly North Malabar and the Wynaad. Cuttings are planted against standards. The crop is perennial and commences to bear after the third year up to the 15th or 20th when it declines. (See Reports of the Taliparamba Agricultural Station.)

Volume weight—1 Madras measure of green pepper weighs 1 lb. when dry.

Weight of seed—1,000 seeds weigh 51·5 grammes.

Number of seeds in 1 lb.—8,800.

Yields in the Wynaad about 5 cwt. per acre, up to 15 cwt. ; in the low country 2 to 3 cwt. is a good yield.

GINGER.

(*Zingiber officinale.*)

Tamil	Inji.
Telugu	Allam.
Malayalam	Inchi.
Kanarese	Hasisuntni.
Oriya	Vodda.
Tulu	Soonti.

The cultivation is practically confined to the West Coast where it is grown on the high lands and heavily manured with leaves. In the Circars, occasionally under shade for green ginger. A variety of ginger with the smell of mangos is occasionally found and is called mango ginger. This is used for making pickles and chutnies.

Seed-rate—1,200 to 2,000 lb. of green rhizomes.

Yield—up to 40,000 lb. of green ginger which will give 2,000 lb. of dry ginger.

FENUGREEK.

(*Trigonella faenumgraecum.*)

Tamil	Venthiam.
Telugu	Menthulu.
Malayalam	Uluma.
Kanarese	Menthiya.
Oriya	Methi.
Tulu	Mente or Metti.

This is grown in gardens and is a three months' crop. It is found near towns as a pot herb in gardens. The seed is used for flavouring curries and is also used medicinally.

Weight of seed—1,000 seeds weigh 11·75 grammes.

Number of seeds in 1 lb.—38,600.

Yield—600 up to 850 lb.

CARDAMOM.

(*Elettaria cardamomum.*)

Tamil	Elakkai.
Telugu	Yelakkayulu.
Malayalam	Elam.
Kanarese	Yalakki.
Tulu	Elakki.

Area—(1903) Madura—4,000 acres : 650,000 lb.
Malabar—1,500 acres : 245,000 lb.
South Kanara—1,260 acres : 68,800 lb.
Coorg—1,100 acres : 50,000 lb.

Its cultivation is practically confined to the hills, where it is grown by planters at a considerable elevation, and also in the submontane tracts of Madura and West Coast where the rainfall is heavy. The crop wants partial shade and a humous soil : it is perennial.

Yield—150 to 300 lb. per acre in an year.

DRUGS AND NARCOTICS.

BETEL.

(*Piper betel.*)

Tamil	Vettilai.
Telugu	Tamalapakulu.
Malayalam	Vettila.
Kanarese	Vilidele.
Oriya	Panno.
Tulu	Baccire.

Area in Madras—23,800 acres.

The varieties grown are numerous, but their names vary from district to district. The crop is a three years' one, and needs constant attention and careful manuring and irrigation. It is usually trained to climb the living stalks of *Agathi grandiflora*, grown for this purpose : it is also trained up bamboos. It is planted from cuttings.

Yield is said to be 80 lakhs of leaves per acre per annum after the first year, but it is very difficult to get accurate figures.

TOBACCO.

(*Nicotiana tabacum.*)

Tamil	Pugaiyilai.
Telugu	Pogaku.
Malayalam	Pukayila.
Kanarese	Hogesoppu.
Oriya	Dhuma.
Tulu	Pugere.

There are numerous local varieties differing in the shape of the leaf, the thickness of the leaf or the midrib and the quality or flavour of the leaf.

The crop is grown extensively. It is sometimes seen as a dry crop, but is more often irrigated though probably the largest crops are obtained on unirrigated lands on the Gōdāvari lankas. The crop is often sold standing as the processes of curing and fermenting are difficult.

Seed-rate—2 oz. of seed mixed with fine sand will sow 200 square feet of seed-bed and will plant out an acre.

Weight of seed—1,000 seeds weigh ·095 gramme.

Number of seeds in 1 lb.—4,775,000.

Yield—900—2,000 lb. of cured leaf.

INDIAN HEMP.

(*Cannabis sativa.*)

Tamil	Ganja.
Telugu	Ganjaya : Ganja : Bangiku.
Malayalam	Kanjavacheti : Kanjavu.
Kanarese	Bhangi : Ganja.
Tulu	Bangi : Ganja.

Area in Madras—300 acres.

It is cultivated only under the supervision of the Abkāri Department. The success of the crop depends on the complete elimination of the male plants, as the narcotic principle is only developed to any extent in the unfertilized female plant.

Yield—said to be up to 200 lb. of prepared ganja in the hills : experimental crops at Coimbatore gave 700—800 lb. per acre.

TINNEVELLY SENNA.

(*Cassia angustifolia.*)

Tamil	... ...	Surat Nilavirai : Nilavakai.
Telugu	... ...	Nelatangedu.

The crop is grown for its leaves which are used medicinally and is found mainly in Tinnevelly in dry, wet or garden lands. Flowers appear after two months and are nipped off, and leaves are first gathered four or five months from the time of sowing. After picking, the leaves are cured under shade for seven days, when they are bagged and sold. The crop lasts on dry land for three years.

Seed-rate—4 to 5 Madras measures.

Weight of seed—1,000 seeds weigh 22·6 grammes.

Number of seeds in 1 lb.—20,000.

Yield – Dry lands, 1st year 700 lb., second and third-half or less ; wet and garden lands—1,400 lb.

SUGARS.

SUGARCANE.

(*Saccharum officinarum.*)

Tamil	...	...	...	Karumbu.
Telugu	...	...	...	Cheruku.
Malayalam	...	...	...	Karimpu.
Kanarese	...	...	...	Kabbu.
Oriya	...	...	...	Akku.
Tulu	...	...	...	Karumbu.

Area in Madras—98,800 acres.

There are numerous varieties and one variety may often be known by different names in different districts. Besides the local canes, there are a number of Mauritius canes and sports from them which are being widely cultivated

in certain tracts. There are further the seedling canes raised from seed in various countries, from which they have been obtained, namely, Barbados and Java. Indian seedlings are now being raised on a large scale at the Government of India Sugarcane Station near Coimbatore.

This is the chief sugar crop although sugar is obtained from the juice of the palmyra, date and coconut palm. It is a twelve-month crop which requires irrigation throughout, and can only be successfully grown on well-drained garden or wet lands of high fertility which must be well-manured.

Seed-rate—10,000 to 35,000 setts (cuttings). These should be cut from the top halves of the cane. Each sett should have at least two if not three joints. Jaggery is manufactured by boiling down the juice extracted by milling the canes in mills with iron rollers.

Extraction—60--70 per cent by weight of the cane is extracted by a good iron roller in form of juice.

Proportion—jaggery to juice : 11—13 per cent.

Yield—4,000 to 10,000 lb. of jaggery.

DYES.

INDIGO.

(*Indigofera Sumatrana.*)

Tamil	Avuri : Nili.
Telugu	Nili.
Malayalam	Nilam.
Kanarese	Nili.
Oriya	Nili.
Tulu	Neeli.

Area in Madras—66,500 acres.

There is only one variety grown in Madras. Its cultivation is steadily decreasing ; but the crop is still found on a fair scale in Vizagapatam, Guntūr, Kurnool, Cuddapah and South Arcot, where the high prices obtainable for the refuse help to keep the industry going. Two or three cuttings are obtained from each crop.

Seed-rate—10 to 15 lb. per acre.

Volume weight—1 M.M. weighs 3 lb.

Weight of seed—1,000 seeds weigh 5·85 grammes.

Number of seeds in 1 lb.—77,500.

Yield—9,000—12,000 lb. green stuff of which 40 per cent should be leaf, and this should give 27 to 30 lb. dry indigo ; as much as 80 lb. may be obtained.

CHAYROOT.

(*Oldenlandia umbellata.*)

Tamil	...	...	...	Chayaver.
Telugu	...	...	...	Chiriverulu.
Malayalam	...	...	...	Chayaver.
Kanarese	...	...	...	Chayaveru.

The plant is of no economic importance now and its cultivation has been abandoned.

DRYAGE OF STORED GRAINS.

It is impossible to give definite figures because conditions vary so widely. The following figures were obtained at Palur, and represent the loss in weight the crop underwent, in the interval between the time it was harvested, and the time it was dry ready for sale :—

Paddy, 8—13 per cent.
Cumbu, 6—13 per cent.
Tenai, 11—17 per cent.
Groundnut*—Irrigated, 25—45 per cent.
Dry, 10—30 per cent.

* This probably includes loss of earth adhering to shell as well as moisture.

COMPOSITION OF FOODS.

Name of food.	Water.	Proteid.	Oil or fat.	Carbo-hydrate.	Crude fibre.	Ash.	Nutritive ratio.
GRAINS—CEREALS.							
Cholam	10·71	9·71	3·69	72·38	1·54	2·05	1 : 8·3
Oats	10·47	7·68	5·69	59·38	12·33	4·25	1 : 9·6
Ragi	11·29	9·44	4·93	60·13	6·56	7·65	1 : 7·5
Paddy...	12·55	6·35	2·14	65·29	7·84	5·83	1 :11·0
Rice	12·25	6·45	·92	78·83	·21	1·33	1 :12·5
Varagu	8·84	8·04	4·57	65·20	7·39	5·95	1 : 9·5
Wheat	13·33	9·74	1·76	70·18	2·10	2·98	1 : 7·7
Maize	10·58	9·66	4·81	71·59	1·43	1·92	1 : 8·5
Kambu	8·77	9·52	5·33	73·52	·78	2·08	1 : 9·0
PULSES.							
Red gram	10·13	17·56	1·34	61·36	5·78	3·78	1 : 3·7
Bengal gram	9·98	18·14	4·39	57·94	6·40	3·15	1 : 3·7
Horse gram	8·82	18·18	·80	62·29	4·13	5·76	1 : 3·5
Field Bean (Lablab)	9·59	21·35	1·25	57·23	6·57	4·01	1 : 2·8
Black gram	9·69	22·81	1·13	59·36	3·27	3·74	1 : 2·7
Green gram	10·38	21·22	1·07	59·58	3·80	4·12	1 : 2·9

COMPOSITION OF FOODS—*cont.*

Name of food.	Water.	Proteid.	Oil or fat.	Carbo-hydrate.	Crude fibre.	Ash.	Nutritive ratio.
OIL-SEEDS.							
Rape seed	6·69	18·29	39·46	23·18	5·24	7·13	...
Safflower	6·22	13·38	26·88	22·93	27·67	2·76	...
Cotton seed (naked from Bellary).	7·49	19·00	19·81	25·71	24·73	3·26	...
Cotton seed (fuzzy)	8·76	17·81	17·40	29·78	22·84	3·41	...
Linseed	5·80	17·91	40·31	26·12	5·27	4·53	1 : 6·6
Gingelly	4·73	19·32	49·13	15·28	4·21	7·32	...
Groundnut	4·70	29·09	49·25	13·21	1·65	2·20	1 : 4·3
CAKES OR POONACS.							
Rape cake	...	31·6	9·6	29·3	11·0	...	1 : 1·6
Safflower	...	37·75	9·8	21·19	20·17	...	...
Cotton seed cake	...	23·5	6·6	32·0	21·1	...	1 : 2
Cotton seed cake (decorticated).	...	40·9	16·4	15·8	9·0	...	1 : 1·3
Linseed cake	9·20	29·3	7·0	32·7	...	...	...
Gingelly cake	10·00	38·0	...	...	...	9·7	...
Groundnut cake	9·91	52·06	7·99	20·68	4·63	4·73	...
Coconut cake	...	20·6	13·2	37·4	14·2	...	1 : 3·3
FODDERS.							
Cholam (green)	69·52	1·36	·48	14·81	10·45	3·67	1 : 11·7

Cholam (straw)	8·70	2·10	1·50	39·67	39·79	8·24	...
Sunnhemp	14·39	11·31	1·12	35·85	27·39	9·94	1 : 3·5
Ragi (green)	80·83	1·94	·48	7·85	5·38	3·52	1 : 4·5
Ragi (straw)	14·16	1·94	·62	49·11	28·93	5·24	...
Paddy (straw)	11·04	2·70	1·02	40·84	29·23	15·17	...
Wheat (straw)	8·71	3·01	·98	37·93	35·69	13·93	1 : 1·3
Maize (green)	88·92	1·13	·31	4·65	3·11	1·88	1 : 4·7
Oat (straw)	12·85	3·83	1·07	51·47	25·23	5·42	...
Varagu (straw)	8·71	1·97	2·51	47·92	28·84	10·05	1 : 26·8
Kambu (straw)	7·07	1·94	1·33	43·99	37·63	8·04	1 : 23·5
Maize ensilage	81·87	·77	·21	9.44	5·50	2·21	...
Cholam ensilage	60·52	1·89	·65	21·37	11·29	4·28	...
Bean (straw)	...	9·9	1·5	31·8	33·5	...	1 : 3·6
Cow Pea (fresh)	...	1·9	·2	7·8	15·3	...	1 : 4·4
Red gram (pods and leaves) ...	8·81	11·01	4·40	44·67	19·23	11·87	1 : 4·9
Bengal gram (pods and leaves)...	8·41	3·65	2·27	45·86	26·71	13·11	1 : 14
Lablab (pods and leaves)... ...	9·92	13·37	3·72	43·03	16·17	13·78	1 : 3·8
Paddy husk (chittu)	8·58	3·85	2·54	34·75	29·24	21·03	1 : 10
Padyy bran (tavudu)	8·21	5·72	8·31	34·25	25·18	18·34	1 : 9·3
Green gram (pods and leaves) ...	13·30	10·88	2·52	40·35	18·66	14·29	1 : 4·2
Wheat bran	11·84	13·20	3·50	58·42	8·42	4·97	...
Dried empty cotton bolls ...	14·23	9·72	1·77	34·08	...	...	...
MISCELLANEOUS.							
Cow's milk	86·33	3·32	4·83	4·60	...	·72	...
Buffalo's milk	82·22	4·34	8·09	4·56	...	·73	...

Composition of Rations.

A satisfactory ration must not only supply the necessary amount of nutrition but must also be sufficiently bulky to fill the animal's belly; it is not possible to keep an animal in health by feeding it only on concentrated food like groundnut cake or cotton seed, but it must also get a bulky fodder. It is important to see that the proportion between the nitrogenous (proteid) and the non-nitrogenous constituents is correct, in order on the one hand to avoid giving too much proteid which is expensive and wasteful, and on the other, diminishing the proteid below what is necessary for the animal's health whether it is a mature bullock or a growing calf. This proportion is called the nutritive ratio, and shows the proportion between the amounts of each *actually digested* by the animals. It is incorrect to work out the ration by the actual quantities found by analysis, though as a matter of fact, it has to be done in many cases, because to find the digestive co-efficient, i.e., the proportion of a substance which is digested, is a tedious business and necessitates actual trial on the animal. The nutritive ratio of a standard diet is worked out in both ways below. To find the nutritive or albuminoid ratio, the average percentages of the various substances are taken, the fat brought to its equivalent in carbohydrate by multiplying it by 2·29, and the total quantity of non-nitrogenous matter is then divided by the total quantity of nitrogenous matter.

For example, let us take the following ration :—1½ lb. cotton seed, 1½ lb. groundnut cake and 20 lb. cholam straw. Then :—

Food.	Quantity.	Albuminoids.		Fats.		Carbohydrates.	
		Per cent.	Amount.	Per cent.	Amount.	Per cent.	Amount.
	LB.		LB.		LB.		LB.
Cotton seed ...	1½	19·00	·28	19·8	·30	25·7	·39
Groundnut cake ...	1½	52·06	·78	7·99	·12	20·7	·31
Cholam straw ...	20	2·10	·42	1·50	·30	39·7	7·93
Total ...	...	...	1·48	...	·72	..	8·63

7·2 × 2·29 = 1·65. 1·65 + 8·63 = 10·28.
Albuminoid ratio = 10·28 ÷ 1·48 = 1 : 7.

If now we take the proportions which are actually digestible we get a somewhat different set of figures. The following digestive co-efficients may be assumed for ruminants :—

Food.	Albuminoids.	Fats.	Carbohydrates
	PER CENT.	PER CENT.	PER CENT.
Cotton seed	67	87	49
Groundnut cake	70	89	49
Cholam straw	46	74	74

The percentages of the constituents will thus be—

Food.	Albuminoids.	Fats.	Carbohydrates.
Cotton seed	12·88	17·25	12·75
Groundnut cake	36·75	7·17	10·15
Cholam straw	0·98	1·11	29·59

and the correct nutritive ratio will be—

Food.	Albuminoids.		Fats.		Carbohydrates.	
	Per cent.	Lb.	Per cent.	Lb.	Per cent.	Lb.
Cotton seed, 1½ lb.	12·88	·19	17·25	·26	12·75	·19
Groundnut cake, 1½ lb.	36·75	·55	7·17	·11	10·15	·15
Cholam straw, 20 lb.	0·98	·20	1·11	·22	29·59	5·92
Total ...	...	·94	...	·59	...	6·26

·59 × 2·29 = 1·35. 1·35 + 6·26 = 7·61,
Albuminoid ratio 7·61 ÷ ·94 = 1 : 8.

Specimen rations.

Bullocks doing hard work.

Food and amount.	Albuminoids.	Fats.	Carbohydrates.
Horsegram, 2 lb.	0·27	0·008	1·00
Cotton seed, 3 lb.	0·39	0·52	0·38
Paddy straw, 25 lb.	0·30	0·12	3·27
Total ...	0·96	0·74	4·65

$0{\cdot}74 \times 2{\cdot}29 = 1{\cdot}69$. $1{\cdot}69 + 4{\cdot}65 = 6{\cdot}34$.
Albuminoid ratio $= 6{\cdot}34 \div 0{\cdot}96 = 1 : 6{\cdot}6$.

Safflower cake, 3 lb.	0·96	0·26	0·51
Cholam straw, 15 lb.	0·15	0·17	4·44
Total ...	1·11	0·43	4·95

$0{\cdot}43 \times 2{\cdot}29 = {\cdot}98$. ${\cdot}98 + 4{\cdot}95 = 5{\cdot}93$.
Albuminoid ratio $= 5{\cdot}93 \div 1{\cdot}11 = 1 : 5{\cdot}4$.

Cotton seed, 4 lb.	0·52	0·69	0·51
Italian millet straw, 20 lb. ..	0·15	0·09	3·89
Total ...	0·67	0·78	4·40

$0{\cdot}78 \times 2{\cdot}29 = 1{\cdot}83$. $1{\cdot}83 + 4{\cdot}40 = 6{\cdot}23$.
Albuminoid ratio $= 6{\cdot}23 \div 0{\cdot}67 = 1 : 9{\cdot}3$.

Food and amount.	Albuminoids.	Fats.	Carbohydrates.
Horsegram, 4½ lb.	·63	·02	2·25
Paddy husk (chittu), 7 lb. ...	·27	·17	2·43
Paddy bran (tavudu), 3½ lb. ...	·20	·29	1·19
Total ...	1·10	·49	6·42

0·49 × 2·29 = 1·12. 1·12 + 6·42 = 7·54.
Albuminoid ratio = 7·54 ÷ 1·09 = 1 : 6·8.

Cows in milk.

Food and amount.	Albuminoids.	Fats.	Carbohydrates.
Groundnut cake, 2 lb.	0·74	0·14	0·20
Green fodder, 70 lb. ...	0·45	0·25	7·67
Total ...	1·19	0·39	7·87

0·39 × 2·29 = 0·89. 0·89 × 7·87 = 8·76.
Albuminoid ratio 8·76 ÷ 1·19 = 1 : 7·36.

Cotton seed, 1 lb.	0·13	0·17	0·13
Grass, say, 70 lb.	0·56	0·20	5·03
Total ...	0·69	0·37	5·16

0·37 × 29 = 0·85. 0·85 + 5·16 = 6·01.
Albuminoid ratio = 6·01 ÷ 0·69 = 1 : 8·71.

Dry cows.

Food and amount.	Albuminoids.	Fats.	Carbohydrates.
Grass, say, 50 lb...	0·40	0·14	3·60
0·14 × 2·29 = 0·32. 0·32 + 3·60 = 3·92. Albuminoid ratio = 0·40 ÷ 3·92 = 1 : 9·8.			
Cholam straw, 20 lb.	0·20	0·22	5·92
0·22 × 2·29 = 0·50. 0·50 + 5·92 = 6·42. Albuminoid ratio = 6·42 ÷ 0·20 = 1 : 32·1.			

Calves.

Food and amount.	Albuminoids.	Fats.	Carbohydrates.
Ground cake, ½ lb....	0·06	0·09	0·06
Cholam, green, 10 lb.	0·64	0·04	1·10
Milk, ½ measure, 2 lb. (cow's) ...	0·06	0·10	0·09
Total ...	0·76	0·23	1·25
0·23 × 2·29 = 0·53. 0·53 + 1·25 = 1·78. Albuminoid ratio = 1·78 ÷ 76 = 1 : 2·3.			
Milk (cow's), 1¼ Madras measures = 5 lb.	0·16	0·24	0·23
0·24 × 2·29 = 0·55. 0·55 + 0·23 = 0·78. Albuminoid ratio = ·78 ÷ ·16 = 1 : 4·9.			
Milk (buffalo's), 1½ Madras measures = 6 lb.	0·27	0·49	0·27
0·49 × 2·29 = 1·12. 1·12 + 0·27 = 1·39. Albuminoid ratio = 1·39 ÷ 0·27 = 1 : 5·1.			

DIGESTIVE CO-EFFICIENTS.

Food and amount.	Albuminoids.	Fats.	Carbohydrates.
Horsegram	75	59	80
Paddy straw	45	47	32
Safflower cake	85	88	80
Italian millet (tenai) straw ...	25	42	54
Green fodder (cholam)	46	74	74
Grass	58	58	48
Milk	94	100	98

Note.—The digestive co-efficients in these illustrations are those which have been worked out for similar foods in other countries. The actual figures may vary very largely from these.

COST OF FEEDING A PAIR OF CATTLE PER ANNUM.

Saidapet, 1885.

	RS.	A.	P.
Fodder, 100 lb. a day at 400 lb. the rupee ...	91	4	0
Cake, 8 lb. a day at Rs. 7 a candy of 500 lb. ...	40	14	0
Interest on value of cattle at 5 per cent on Rs. 100	5	0	0
Depreciation at 10 per cent per annum	10	0	0
Shoeing twelve times a year at 12 annas ...	9	0	0
Contingencies	3	14	0
Total ...	160	0	0

Coimbatore, 1911.

Cholam straw—January, February and March 90 days—30 lb. a day ; 2,700 lb. at 250 lb. a rupee	10	12	10
Tenai straw - April 30 days—30 lb. a day ; 900 lb. at 150 lb. a rupee	6	0	0
Wheat straw and gram pottu ; May 31 days—30 lb. a day ; 930 lb. at 500 lb. a rupee	1	13	9

	Rs.	A.	P.
10 lb. of green fodder a day additional in May, 3,100 lb. at 300 lb. a rupee	1	0	6
Paddy straw—June, July and August, 122 days—30 lb. a day, 3,660 lb. at 150 lb. a rupee.	24	6	5
Ragi straw, October 31 days, 80 lb. [green] a day, 2,480 lb. at 400 lb. a rupee	6	3	2
November, 30 days, 40 lb. [dry] a day, 1,200 lb. at 250 lb. a rupee	4	12	9
Grass—December 31 days, at 100 lb a day, 3,100 lb. at 500 lb. a rupee	6	3	2
Groundnut cake $365 \times 3 = 1,095$ lb. at Rupees 78-12-0 a ton	46	7	0
Cotton seed $365 \times 3 = 1,095$ lb. at Rs. 95 per ton.	46	7	0
Salt 365×2 tolas or $\frac{730 \times 2}{5 \times 16}$ lb. or $18\frac{1}{4}$ lb. at 6 pies a lb.	0	9	2
Shoeing four times at 12 annas	3	0	0
Interest at 5 per cent on Rs. 200	10	0	0
Depreciation at 10 per cent on Rs. 200	20	0	0
Attendance	12	0	0
Contingencies	3	3	4
Total ...	195	0	0

COST OF FEEDING COWS PER ANNUM.

Saidapet, 1885.

11,000 lb. of green food	36	12	0
1,500 lb. oil cake	21	0	0
730 lb. wheat bran	18	4	0
730 lb. dholl husk	11	6	0
20 lb. salt	0	10	0
Attendance and sundries	18	0	0
Interest on value of cow Rs. 150 at 5 per cent and depreciation at 10 per cent	22	8	0
Total ...	128	8	0
Deduct—One-third value of artificial food chargeable to manure	16	8	
Net cost per annum ...	112	0	

Coimbatore.

(In milk 10 months, 304 days.)

	Rs.	A.	P.
Cotton seed, 1 lb. a day, 304 lb. at Rs. 95 a ton	12	14	3
Groundnut cake, 1 lb. a day, 304 lb. at Rupees 78-12-0 a ton	10	11	0
Dholl husk, 2 lb. a day, 608 lb. at Rs. 1-3-0 for 50 lb....	14	7	0
Green cholam fodder, 40 lb. a day, 9,680 lb. for 242 days at 300 lb. a rupee	32	4	3
Green grass, 60 lb. a day, 3,720 lb. for 62 days at 500 lb. a rupee	7	7	0
Salt, 1 tola a day, 304 tolas for 304 days or 7½ lb. at 6 pies a lb.	0	3	8
Total ...	77	15	2

(Dry two months.)

Dry cholam fodder (straw) 20 lb. a day, 1,220 lb. for 61 days at 250 lb. a rupee	4	14	2
	82	13	4
Attendance*	18	0	0
Depreciation at 10 per cent per annum on Rs. 80.	8	0	0
Interest at 5 per cent on Rs. 80	4	0	0
Contingencies	1	11	8
Total ...	114	9	0
Deduct—One-fourth value of artificial food chargeable to manure	9	9	0
Net cost per annum ...	105	0	0

COST OF FEEDING CALVES.

First year.

Milk for the first two months, 30 Madras measures at 4 annas a Madras measure ...	7	8	0
Groundnut cake, ¼ lb. a day for 10 months, 76 lb. at Rs. 78-10-0 per ton	2	10	9

*One man on Rs. 8 and one boy on Rs. 4 a month of every eight cows.

	Rs.	A.	P.
Cotton seed, ¼ lb. a day, for 10 months, 76 lb. at Rs. 95 per ton	3	3	7
Dholl husk, ¼ lb. a day, for 10 months, 76 lb. at Rs. 1–3–0 for 50 lb.	1	12	11
Salt	0	0	10
Fodder similar to that of cows, at one-fourth their rate	8	0	0
Attendance*	2	0	0
Total	25	4	1

Second year.

Groundnut cake, ½ lb. a day, 182½ lb. at Rupees 78–12–0 per ton	6	6	8
Cotton seed, ½ lb. a day, 182½ lb. at Rs. 95 per ton.	7	11	10
Dholl husk, ½ lb. a day, 182½ lb. at Rs. 1–3–0 for 50 lb.	4	5	4
Salt	0	1	0
Fodder, similar to that of cows, at half their rate.	20	0	0
Attendance	2	0	0
Total	40	8	10

Third year.

Groundnut cake, ¾ lb. a day, 274 lb. at Rupees 78-12-0 per ton	9	10	0
Cotton seed, ¾ lb. a day, 274 lb. at Rs. 95 per ton.	11	9	9
Dholl husk, ¾ lb. a day, 274 lb. at Rs. 1-3-0 for 50 lb.	6	8	0
Salt	0	1	0
Fodder, similar to that of cows at half their rate.	20	0	0
Attendance	2	0	0
Total	49	12	9
Total for three years	115	9	8
Contingencies for three years	4	6	4
Grand total	120	0	0

* This has been calculated at the rate of Rs. 4 (one boy) for every 24 calves per month all through.

Rations.

(Fed to calves at the Military Dairy Farm, Bangalore.)

First period—birth to 21 days ...	6 lb. whole milk given three times a day.
Second period—third to fifth week.	Whole milk ... 1 lb. Separated „ ... 5 „ Barley meal ... 1 „ Linseed oil ... 1 oz.
Third period—sixth week to third month.	Separated milk. 2 lb. Barley meal ... 4 „ Linseed oil ... 1 oz.
Fourth period—fourth to fifth month.	Barley meal raised to 6 lb.
Fifth period—sixth to eighth month.	Barley meal gradually reduced until none is given. Green fodder is now given and a ration of 1 lb. wheat bran; ½ lb. oil cake and ¼ oz. salt, each day.

From ninth month on the normal young stock ration is fed, viz.:—

Wheat bran	1 lb.
Decorticated cotton cake	1 „
Green fodder	15 „

or

Second period—third week to sixth month.	Whole milk ... 1 lb. Separated milk ... 5 „ Cotton seed meal. 1 „ Fodder as much as they will eat.
Fourth period—sixth to eighth month.	Cotton seed meal. 1 lb. Hay ... ... 15 „ Salt ... ... 2 oz.
From ninth month	Cotton seed meal. 2 lb. Cotton seed hulls. 1 „ Rice bran ... 1 „ Salt ... ... 2 oz. Hay ... ... 15 lb.

Pasturage fees.

In the northern deltas, Rs. 20 to Rs. 30 are charged for grazing a pair of bullocks for four months—August to September—including watching charges.

LIVE-STOCK.

Names of cattle.

Male.

At birth.—Bull calf; if castrated, bullock calf or stot calf.

When a year old.—Yearling bull or year-old bull; if castrated, year-old stot or steer.

When two years old.—Two-year old bull; if castrated, two-year old stot or steer.

When three years old and upwards.—Three-year old bull or bullock (if castrated), four-year old bull or bullock, five-year old bull or bullock, aged bull or bullock; or

Two-teeth bull or bullock, four-teeth bull or bullock, six-teeth bull or bullock, full mouthed bull or bullock, aged bull or bullock.

Female.

At birth.—Heifer calf or cow calf.

When a year old.—Yearling heifer or year-old heifer.

When two years old.—Two-year old heifer.

When three years old.—Three-year old heifer.

A cow or heifer that has received the bull is said to have been served or bulled and, if in calf, is called cow in calf or heifer in calf.

A heifer becomes a cow on bearing a calf.

A cow in milk is termed a milk or milch cow (Tamil *Karavai*). When she ceases milking, she is a dry or yeld cow (Tamil *Varadu*).

Cows, as a rule, bear one calf at a time. If two are born at one birth, they are termed twins, if three, triplets. When a bull and heifer calf are born twins, the latter is called a free-martin and is usually barren.

Breeding.

Cattle are bred in India for draught and milk purposes. Draught cattle are used for the plough, the mhote and the cart. Bullocks are also used as beasts of burden. Of the several breeds in Southern India, the pre-eminent and the best defined ones are the Ongole and the Mysore. The Ongoles are huge in size and are suitable for a steady, heavy draught. The cows on an average give 6 to 10 lb. of milk

per day. The best ones may yield as much as 15 to 20 lb. in 24 hours. The Mysore cattle are quick of pace and very spirited and are specially suited for road work. The cows are poor milkers. Between these two extremes are all the remaining several breeds, in which the working and milking capabilities are combined and are of a medium standard. Indian heifers, as a rule, do not come in heat until they are from 3½ to 4 years old, but some take the bull as soon as they have cut the first pair of teeth, that is, when they are 2½ years old, and instances are known in which heifers have produced their first calves before cutting the first pair of teeth. It is quite safe to breed from heifers which have cut the first pair, and it is desirable from the point of view of saving in the matter of keep, that they should be so bred from. Early maturity can be secured by proper feeding and care. Indian cattle tend to go dry for a long time. They are not fed when they are dry and it does not pay the owner to do so. There is no reason why cows when they are dry, should not be used as draught animals until they are within a month and a half or two of calving, and fed and looked after well. This practice obtain in some parts of Coimbatore and Salem districts, and deserves further extension. A cow comes in season, as a rule, every three weeks, but this varies very much with different animals. A good cow should average a calf a year; this means she should take the bull two to four months after calving. A cow after calving should not be given the bull, even if she comes in heat, until two months have elapsed since calving. Some cows may go on milking during the whole period of pregnancy. In such cases they should be dried when they are within a couple of months of calving, so that the mammary glands may have rest and the process of the secretion of new milk may go on undisturbed. Heifers should not be allowed to get too fat, as oestrum is liable to be delayed, and they may even go barren. The breeding bull should be particularly selected as his influence on the progeny is extensive, and as he becomes the sire of many animals. A bull should not be used for breeding before he has at least cut he first pair, that is about 2½ year old. He is in his vigour from the third to the eighth year, after which he should be discarded. He must be fed well, and light and regular work will keep him in good condition, health and spirit. The average period of gestation in cows is 9½ months or 285 days. It is said that they go longer with a bull calf than with a heifer, which is, however, not confirmed by observation. The signs of pregnancy in a cow are these. She does not

come in heat again, and there is improvement in her condition. The abdomen enlarges and becomes pendulous, particularly on the right side. The udder increases in size, and the mucous discharge from the genital parts is also increased. After the fifth month, fœtal movements can be perceived by looking at the flank on the right side. Abortion or miscarriage occurs occasionally. It is due to the nature of the food and other influences. Pregnant animals when affected with blood diseases may abort. Abortion is also caused by certain bacterial organisms, and therefore rigid separation of animals which have aborted from those which are pregnant should be attended to. Approaching parturition is indicated by the swelling of the udder and occurrence of milk in it, discharge of thick mucus from the vulva, and the loosening or 'slipping' of the hinder parts, due to the relaxation of the pelvic ligaments. The process of parturition occupies about an hour. The placenta or after-birth comes away in ½ to 4 hours after the calf has been dropped.

Rearing.

The calf is allowed to suck its mother both before and after milking. In some parts the calf is tied to the arm of the mother and is allowed to suck only after milking. In Europe the general practice is to separate the calf from the dam as soon as it is born, or in a week or ten days after birth and to hand-feed it. Both the systems have their advantages and disadvantages. Allowing the calf access to the mother acts as a stimulus for the secretion of milk and ensures the udder being thoroughly emptied after each milking, and the cow yields her milk freely. When the cow is out grazing, there is no danger of her milk being drawn stealthily. The disadvantages are that the cow may not give milk if the calf dies, and that it is difficult to regulate the amount of milk to be left for the calf. Under the European system, the calf is given a regulated and required amount of milk, and the cow can be milked whether the calf is alive or dead, but there is no certainty of the milkman stripping the udder thoroughly. As soon as cow has calved, she should be milked and a portion of the milk should be given to the calf or left in the udder for it to suck. The milk yielded for the first four or five days is called *colostrum* ; it contains a high proportion of albumen and curdles when boiled. It is called in Tamil '*seempal*,' that is, '*pus milk*.' This milk contains some laxative principle and helps to clear the intestines of the calf of *meconium*. Some cows do not secrete milk on the very first day

of calving. In such a case an ounce or two of castor oil may be given to the calf. During the first month the calf should get sufficient milk, 2 to 4 lb. a day according to its size. If the cow is a poor milker, the whole of the milk should be left to the calf. During the next month, half this quantity may be allowed, the calf being taken out for grazing or supplied with grass and also given a little special food—skimmed milk, butter milk, linseed meal or rice or cholam or kambu conjee. Hand-fed calves may be weaned when 4 to 6 months old.

Bulls are castrated in this country when they are four and five years old, the objection to earlier castration being that the growth is stunted. Unfortunately this leads to promiscuous breeding, young and unsuitable stock being allowed to cover cows. It is still a matter for question, as to the best age at which to castrate young bulls, so far as their growth and nature is concerned. Young animals should get exercise. Even when there is no grazing available, they must be taken out for a run. The weight of calf at birth is 1/15 to 1/12 of that of the mother. Nellore calves weigh 40 to 50 lb. at birth and Kangayam and big sized country calves 30 to 40 lb.

Feeding.

After a calf has been weaned, it must be fed liberally and regularly as the animal goes on continuously growing. It is only a well fed calf that will grow into a good bull or heifer. Bad or interrupted feeding during the early years tells upon the system throughout life. In addition to good grazing or supply of fodder and grass, which forms the bulk of food in cattle of all ages, the young stock should get a certain amount of concentrated food. The tissues of the body among other elements contain nitrogen. Nitrogen is not contained in all food stuffs but the other elements generally are. The special food given to young stock should therefore be rich in nitrogen. Nitrogen is found in cotton seed and in pulses such as grams, groundnuts, etc. A mixture of equal parts of horsegram, cotton-seed and groundnut cake will be a proper food for young stock. Young animals should be let loose daily for grazing and exercise. Ryots take care of their bull calves but neglect their heifer calves. It is very right to feed and look after the bull calves well, so that they may grow into good breeding bulls or draught cattle, but it is wrong to neglect the heifer calves. If heifers are required for breeding they must be brought up well. Both the sire and the dam influence the progeny, although the former has more influence in the herd. A dairy cow in milk must be fed well and regularly. She

must get some green fodder or grass and also some nitrogenous and fatty food stuffs, such as oil-cakes and cotton seed. Bulls and working cattle should, in addition to fodder and straw, get some special food. Common salt is as necessary to cattle as it is to man, and a tola or two per head should be given daily mixed with food. Proper housing must be provided, and cattle must be protected from exposure and wind during inclement weather.

Age of cattle.

The age of cattle is estimated by means of the teeth and also by the rings or nicks round the horn. The first ring appears at the third year, and then each year is supposed to add a ring, so that if there are two rings, the animal is considered four years old, if three rings, five years old and so on. The rings are, however, not always well marked, and it is much safer to judge the age by the teeth.

Dentition.—The dentition of cattle is typical of the ruminants. At or within a month after birth the calf has eight incisors, or six incisors and two canines, in the lower jaw (the canines are shaped exactly like the incisors and situated close to them and are generally regarded as incisors) and twelve premolars, three on each side above and below. The upper jaw has no incisors nor canines and is provided instead with a cartilaginous pad (dental pad). All these are temporary or milk-teeth, and they are replaced later by permanent ones. Three molars on each side of each jaw behind the premolars come up and complete the permanent dentition. The number of permanent teeth is thus 32. Until the eight permanent incisors are completed when the animal is said to be full-mouthed, the age can be told with correctness. After this, ageing is a matter of guesswork from the extent to which the teeth are worn.

Dental formula for milk teeth—

$$\text{Incisors } \frac{0-0}{4-4},\ \text{premolars } \frac{3-3}{3-3}.\quad \text{Total } 20.$$

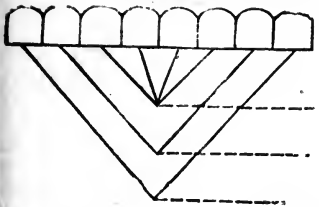
Dental formula for permanent teeth—

$$\text{Incisors } \frac{0-0}{4-4},\ \text{premolars } \frac{3-3}{3-3},\ \text{molars } \frac{3-3}{3-3}.\quad \text{Total } 32.$$

The top figures show the teeth on each side of the upper jaw and the bottom figures the teeth on each side of the lower jaw.

Teeth indicating age—

(Appearance of temporary incisors.)

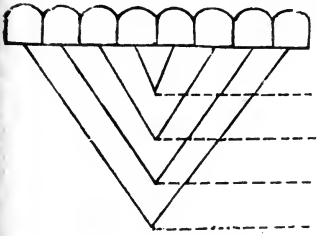


At birth or 1 week.

2 weeks.

3 to 4 weeks.

(Appearance of permanent incisors.)



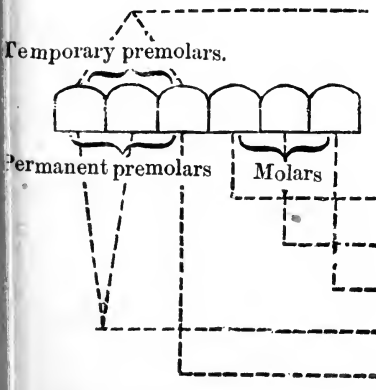
2 years 6 months.

3 years 6 months.

4 years 6 months.

5 years 6 months.

(Appearance of molars.)



3 to 4 weeks.

9 months.

1 year 6 months.

2 years 3 months.

$2\frac{1}{2}$ to 3 years.

3 to $4\frac{1}{2}$ years.

Calving table.

Average period of gestation, 285 days.

If served on		Will calve about		If served on		Will calve about	
January	1	October	13	July	1	April	12
,,	7	,,	19	,,	7	,,	18
,,	14	,,	26	,,	14	,,	25
,,	21	November	2	,,	21	May	2
,,	28	,,	9	,,	28	,,	9
,,	31	,,	12	,,	31	,,	12
February	1	,,	13	August	1	,,	13
,,	7	,,	19	,,	7	,,	16
,,	14	,,	26	,,	14	,,	26
,,	21	December	3	,,	21	June	2
,,	28	,,	10	,,	28	,,	9
March	1	,,	11	,,	31	,,	12
,,	7	,,	17	September	1	,,	13
,,	14	,,	24	,,	7	,,	19
,,	21	,,	31	,,	14	,,	26
,,	28	January	7	,,	21	July	3
,,	31	,,	10	,,	28	,,	10
April	1	,,	11	,,	30	,,	12
,,	7	,,	17	October	1	,,	13
,,	14	,,	24	,,	7	,,	19
,,	21	,,	31	,,	14	,,	26
,,	28	February	7	,,	21	August	2
,,	30	,,	9	,,	28	,,	9
May	1	,,	10	,,	31	,,	12
,,	7	,,	16	November	1	,,	13
,,	14	,,	23	,,	7	,,	19
,,	21	March	2	,,	14	,,	26
,,	28	,,	9	,,	21	September	2
,,	31	,,	12	,,	28	,,	9
June	1	,,	13	,,	30	,,	11
,,	7	,,	19	December	1	,,	12
,,	14	,,	26	,,	7	,,	18
,,	21	April	2	,,	14	,,	25
,,	28	,,	9	,,	21	October	2
,,	30	,,	11	,,	28	,,	9

Common diseases.

Simple fever.—This may be brought about through changes of weather, change of food, or exposure. It is ushered in with a shivering fit, which is followed by hurried breathing and with temperature increased to 104° to 106°. Confine the animal to the stall. Give as drench 8 to 12 ounces of Epsom salts with an ounce of nitre. Then give twice a day an ounce of common salt and two drams of nitre in a pint of water. The patient must have green grass and plenty of pure drinking water. When free from the complaint an ounce of powdered chirata with two drams of black pepper in a pint of water or gruel may be given once daily for a few days.

Rheumatism.—A common complaint in India. It results from the inflammation of the fibrous tissue through exposure to wet and damp. It is most common in the south-west monsoon—June to September. Young animals between the ages of one and five are most liable. There is high fever attended with stiffness and pain in moving. The animal walks very lame. It soon lies down and is unable to get up. The attack lasts for about three days, when fever and lameness disappear, but stiffness in gait remains for some time. Give at once a pound of Epsom salts with half an ounce of ginger in sufficient quantity of warm water. The animal must be provided with a good bed and have placed before it green grass and pure fresh water with a little nitre dissolved in it. After recovery two ounces of sulphur may be given once daily for a few days.

Cancer.—Cancerous tumours and sores are not uncommon in cattle. The only plan is to remove the diseased part completely by surgical means. If this is not possible, the disease cannot be eradicated. Mild caustics may be used as a palliative measure.

Tuberculosis.—This is what is commonly known as consumption in man. It attacks cattle and other domesticated animals. The disease is infectious. The cause is an organism known as *Bacillus tuberculosis*. It is a blood disease, but the organs particularly affected are different in different attacks. The lungs are the organs most frequently attacked, but the liver and intestines and other abdominal organs may also be the seat of the disease. Joints are sometimes affected. The affected animal is out of condition and falls away in flesh. The fæces are offensive and loose. When the lungs are affected there is also a cough, which is weak and coarse. *Post-mortem* examination shows the presence of small nodules or tubercles in the organs affected. There is no known cure

for the disease. Young animals and cows five to eight years old are most liable. Infected animals must be removed from the herd. They are unsafe to use either for breeding, milking or for human food.

Pleuro-pneumonia contagiosa.—Inflammation of the lungs and pleura may be simple or contagious. The latter is a specific form and is contagious and infectious. It is fortunately rare in India. There is fever and general signs of disease. The breathing is hurried, the muzzle is protruded and the patient grunts and moans during respiration. Pressure between the ribs makes the animal grunt from pain. Purging sets in and the animal dies eventually of suffocation and exhaustion. Affected animals must be isolated. Ten drops of carbolic acid may be given twice daily in rice gruel. Turpentine must be well rubbed in on the throat and chest. The disease is almost always a fatal one and it is best to destroy the animal in the early stage.

Foot-and-mouth disease.—A highly infectious and contagious disorder attacking cattle principally, but also transmissible to sheep, goats and buffalos. The period of incubation varies from one to four days, and the disease shows itself with an elevation of temperature from two to five degrees. The disease is characterised by the appearance of vesicles or blisters in the mouth and between the toes and, in cows, on the udder also. The blisters soon burst leaving raw sores. There is saliva foaming from the mouth, with a peculiar smacking of the lips and tongue. The feet are so sore that the animal is extremely lame, and moves with great difficulty. Mortality is very rare in adult animals, but the disease may prove fatal to very young calves. The diet must be nutritious and soft, such as rice or other grain, gruel and green grass. Give a mild purgative at the commencement. Wash the mouth once daily for two or three days with alum lotion—20 to 30 grains to an ounce of water. The feet must be kept clean and dressed with carbolic, camphor or margosa oil. If the udder is affected, treat as in *mammitis*. The milk of the affected animals should not be used without being well boiled.

Rinderpest.—This is the most formidable disease in cattle and is highly infectious and contagious. It also attacks sheep, goats and buffalos. In virulent outbreaks, mortality is 80 to 90 per cent, in ordinary, 40 to 50 per cent. The period of incubation lasts from four to eight days but may extend even to 14 days. In the beginning there are all the general signs of disease. There is fever, persistent shivering, congestion of the mucous membranes of the mouth, nose, eyes and vagina, followed with a discharge of acrid tears from the eyes, and of

copious saliva from the mouth, and a muco-purulent discharge from the nose and the vagina. There are often sores in the mouth. Bowels are at first constipated, but soon fetid diarrhœa of a dirty yellow colour with mucus and blood in it sets in. The prostration of strength is very great. In milch cows the secretion of milk entirely ceases. Duration of the disease is from 2 to 10 days. As a rule, a crisis sets in about the sixth or seventh day and the animal dies or shows signs of recovery. Treatment: at the commencement, when the bowels are costive, give once daily, until the bowels get loose, 8 to 10 ounces of castor or linseed oil. Twenty to 30 minims of carbolic acid may be administered in a pint of warm gruel once daily. If there be bloody diarrhœa, give some astringent (see Recipes). Diet must consist of fresh young grass and of gruel, which must be gently drenched down if the animal will not take it of its own accord. Affected animals should be strictly isolated. The carcases with the dung, litter, etc., should be burned or buried deep with quicklime.

Cow-pox.—A specific eruptive fever in cattle. It is of rare occurrence. Cows are more liable to it than bulls, and cows after calving are most liable. It is not a severe affection. The eruptions show themselves in the region of the udder and teats in the form of circular vesicles with a central depression. The vesicles contain a clear fluid termed lymph, which gradually becomes opaque and purulent. In the course of a few days the pustules burst and scales form, which soon drop away. The disease terminates in about three weeks and calls for no special treatment. If the udder is much inflamed, foment with hot water twice daily, and after milking, dust a little powdered chalk or alum over the sores. Isolation is seldom necessary. Milk of the affected animals must be rejected. It is with the lymph contained in the vesicles of cow-pox that man is vaccinated as a protection from small-pox. One attack of cow-pox gives the animal immunity from the disease in future.

Haemorrhagic septicæmia.—This term includes a variety of diseases. Buffalo disease. Deer disease, Gloss-Anthrax, Swine plague, Fowl cholera, Contagious Pneumonia of the horse, etc. The agent that produces this disease is a cocco-bacillus or Pasteurella. In cattle it is found in three forms mostly commencing to attack buffalos (hence the name). They are as follows :—

i. Exanthematic.
ii. Lung form.
iii. Intestinal form.

The first form of this malady is characterised by its rapidity of onset and course and its fatal termination. The

animal is off feed, rumination suspended, temperature rising very high as 108° to 109° F. There is hurried breathing with great distress, and often a bloody discharge from the nostrils and bowels. Large swellings of a tense nature appear at the throat, in the dewlap and sometimes over the fetlocks and shoulder. In some cases the throat swelling is so great that the animal is totally unable to breathe or swallow. The tongue swells up very much and hangs out. The mouth is frothy, the visible mucous membranes are purple coloured, and death often occurs in a few hours. In the other two forms the lungs and digestive organs are chiefly affected, the animal having an acute pneumonia and pleurisy in the lung form and inflammation of the alimentary canal in the third form.

The disease often occurs in an area as an outbreak and is worst on marshy low-lying pastures and badly drained and ill-ventilated sheds.

Treatment is not of much avail. Preventive measures to be adopted are segregating the sick animals, and removing from unhealthy surroundings. Treat sick animals with a dram of carbolic acid in a pint of linseed or castor oil internally or soda hyposulphate 1 oz. morning and evening in drinking water. Tincture of iodine, liniments and fomentations may be applied to the swellings. Healthy animals may be protected by subcutaneous injection of anti-Hæmorrhagic Septicæmic serum.

This disease can be differentiated from Rinderpest by the absence of mouth lesions and sudden onset of symptoms. The carcases of animals affected with this disease have to be disposed of in the same way as Anthrax and disinfection carried out the same manner.

Anthrax.—This is a specific contagious disease attacking cattle and other domestic animals. It is caused by the presence of an organism in the blood called *Bacillus anthracis*. The disease is highly fatal (95—99 per cent) and runs a rapid course from a few hours to a few days. It is communicable to man. It appears mostly in two forms.

Splenic form.—This form is called splenic fever and is characterised by a very high fever, discharge of bloody fæces and high coloured urine, and tympany; death ensues in a few hours. In many instances animals seen apparently in good health a few hours before are found dead suddenly. On *post-mortem* examination the spleen is found considerably enlarged, and distended with tarry blood.

Enteric form.—All the above mentioned symptoms are noticed and in addition there is severe colic and dark coloured

blood escapes with the fæces from the bowels. Here also death occurs within a few hours.

Treatment is not of much avail. The animal should at once be isolated and the whole place thoroughly disinfected. A dram of carbolic acid in a pint of linseed oil may be given at once. The carcases of animals that have died of this disease should either be burned or buried deep with quicklime. They should be covered with straw to prevent discharges falling to the ground from the natural openings and then removed to the burial or burning ground. The earth in the sheds for about six inches must be dug and replaced with fresh earth and quicklime, and the whole place thoroughly disinfected with strong antiseptic lotions, after burning a layer of straw on the floor. Temporary isolation sheds are better burned after an outbreak. Thorough scrubbing of the walls with antiseptic lotion and whitewashing should be insisted on in permanent sheds.

Black-quarter or quarter ill, black leg or quarter evil.—This disease was until recently supposed to be a kind of anthrax. It is an infectious bacterial disease manifested by high temperature, lameness and a localised hot, painful swelling on the shoulders, quarter, neck, leg, trunk or elsewhere. The swellings mostly occur in the limbs and quarters, and hence the name black-quarter. Cattle of all ages are liable to infection; but the disease begins in animals under two years of age and rarely in adult cattle. Suckling calves fed only on milk are free. It is a disease that is worst in low-lying marshy pastures.

The swelling at first is small, hot, tender and pits on pressure. It extends to 12 inches or more in diameter in a few hours, and becomes dry and parchment like. Decomposition takes place inside ; the swelling becomes cold, the parts inside gangrenous, and the skin becomes insensible.

Preventive treatment consists in changing the pasture, and in inoculating healthy animals with black-quarter vaccine, which is prepared out of muscle-juice from an infected part. The ends of the ears and the tail are the seats of inoculation, which should be done with proper antiseptic precautions by a trained veterinarian. Sick animals should be isolated at once and strict disinfection should be carried out. A dose of linseed oil (1 pint) with a dram of carbolic acid may be given without delay. The tumours in several places may be scarified and a saturated solution of potassium permanganate may be applied, or strong antiseptics or caustics as pure carbolic acid or equal parts of turpentine, tincture of iodine and liquor ammonia may be applied. In

animals that recover, internal tonics as tincture ferri perchloride, 1 ounce in a pint of water may be given once daily, and externally the diseased parts will have to be treated surgically as wounds or abscesses.

Choking.—Cattle are sometimes choked with pieces of oil cake, palmyra nuts, stalks of cholam. The animal is uneasy and restless and there is no rumination. It coughs and salivates and, when it attempts to drink, water returns through the nostrils. If the obstruction can be reached by the hand, attempt must be made to remove it. If the impaction be lower down in the gullet beyond the reach of the hand, pour down the throat a little oil and then work the obstacle up and down when it may be dislodged and will descend into the stomach. Should this prove unsuccessful, the probang ought to be used and, in the absence of one, a rattan 6 feet long and half an inch in diameter covered at one end with soft cloth or wash leather may be substituted. The mouth must be kept open by the introduction across it of a piece of wood with a hole in the centre to allow of the cane being passed through. The obstruction must be gently pushed down into the stomach.

Tympanitis; Hoven.—A common complaint among cattle in India. It is due to the distension of the rumen with gas. The cause is generally a too free use of succulent fodder or grass. There is uneasiness and pain, and a swelling on the left side of the belly, which, when struck, sounds like a drum. The animal is unable to breath freely and grunts. In severe cases, relief should be afforded at once or the animal may die of suffocation. Give at once a pint of linseed oil with an ounce of turpentine in it (see also Recipes) and administer enemas of warm water. Should relief be not obtained in a few hours, and should the symptoms become aggravated, puncture the rumen with a trocar and canula on the left side at a point equally distant from the point of the hip, the last rib and the transverse processes of the lumbar vertebræ. If this instrument is not to be had, plunge the large blade of a pocket knife into the stomach and turn it crossways, when the gas will escape.

Impaction of the rumen.—This is distension of the rumen with food. Some particular foods are liable to cause this disorder, but anything particularly palatable and eaten to excess may produce the disease. The abdomen is distended on the left side but percussion elicits a dull sound and the swelling pits on pressure. If not relieved soon enough, tympanitis may supervene and the animal may die of suffocation. Give immediately an oil purgative with a strong

stimulant, linseed or castor oil two pints, croten oil thirty minims, powdered ginger one ounce. Administer copious and frequent enemas of warm water. Should relief be not obtained by the above measures, the only remedy is to perform "ruminotomy," that is, to cut into the stomach and remove its contents through the incision. This operation should only be attempted by a practised hand.

Diarrhœa.—Frequent evacuations of excessively fluid fæces. The causes are many, such as unwholesome food, free consumption of fresh young grass springing up after rains, scanty pasturage in the hot weather, sudden change of food from dry to green, change of seasons from hot to cold and *vice versâ*. Impure water may also cause diarrhœa. In most cases, it would be well to clear the bowels with a laxative dose of castor or linseed oil—15 ounces of oil with a dram of ganja. The food must be carefully examined, and changed if necessary. Should diarrhœa persist, give daily for a few days an astringent drench (see Recipes).

Dysentery.—This is caused by inflammation of the membrane lining the bowels. It is a frequent accompaniment of blood disorders. Simple dysentery may follow protracted and neglected diarrhœa, or may originate from exposure to cold, coarse, innutritious food or fodder, impure water, etc. It may also be an after-effect of poisonous agents. Give once daily or on alternate days, according to the nature of the case 8 ounces of linseed oil with a dram of ganja or of opium. Rub the flanks well with equal parts of mustard and turpentine. A course of astringents may also be administered if necessary (see Recipes).

Hepatitis.—Inflammation of the liver. It may be caused by an excessive amount of highly stimulating food, associated with want of exercise. The disease is also attributed to changes of temperature and of food. It is most frequent in the hot weather. Fever may be present. The eyes and the skin are yellow. There may be perceptible enlargement on the right side with tenderness on pressure. Give frequent saline purgatives so as to keep the bowels loose for a week or ten days. Then give once or twice daily for a few days 2 drams each of camphor, aniseed and fenugreek in a pint of warm gruel.

Bronchitis.—Inflammation of the trachea and bronchial tubes. It is usually acute but may be chronic. The common causes are exposure to cold and dampness, sudden changes of temperature or over exertion. The disease begins with a chill followed by high fever. The respirations are hurried.

There is cough, which in the early stage is dry, but in the later stages becomes moist, with a mucous discharge from the mouth and nostrils. The bowels are generally costive. Administer enemas and a saline purgative. The air passages may be steamed and stimulating applications rubbed on the sides of the chest and the course of the trachea. The patient must be allowed a free supply of pure air, of tempting food and of nitrated drinking water—2 ounces of nitre dissolved in a gallon of water. Later, give a few expectorant drenches (see Recipes).

Young calves are subject to a parasitical bronchitis called "husk" or "hoose." This is caused by a species of thread worm known as *Strongylus micrurus*. There is a husky cough. Give ½ ounce of turpentine in 3 ounces of linseed oil twice a week. Fumigation with chlorine, carbolic acid or sulphur is supposed to kill the parasite.

Pneumonia; *Inflammation of the lungs*.—This disease may be accompanied with pleurisy (inflammation of the pleura). The causes are the same as those of bronchitis. There is quick and laborious breathing; the mouth is hot but the horns, ears and feet are often excessively cold. There is also a frequent sore cough. Give an aperient of Epsom salts and a free supply of nitrated water to drink. The patient must be well housed and kept warm. Rub turpentine on the chest twice daily, until it becomes slightly sore. A seton may be inserted in the dew lap.

Red water; *Black water*.—This disease sometimes shows itself in cows after calving. The urinary organs get irritated and the cow strains frequently and passes urine in small quantities tinged with blood. Later, the secretion may become black or brownish black. Keep the cow quiet and give her drinks of linseed tea or of thin rice gruel in which some nitre should be dissolved. Three or four ounces of Epsom salts may be given once daily in the form of a drench for about a week.

Nephritis; *Inflammation of the kidney*.—This is a frequent complaint in cattle, specially working bullocks, as a result of violent strains or blows on the loins. It may also arise from sudden changes in the temperature and exposure to wet and cold. There are general febrile symptoms. If both kidneys are affected, no urine is passed; if only one, a diminished supply of a thick, viscid character containing blood and pus is passed in small quantities with straining. When pressed on the loins, the animal flinches. The gait is straddling and painful. Foment the loins with warm water

frequently and give warm enemas. Administer 8 or 10 ounces of linseed oil with a dram of opium and repeat on the following day if necessary. Give linseed tea to drink freely.

Mange.—A contagious disorder of the skin due to the ravages of a mite known as "*Acarus bovis.*" There are many forms of this mite, but the most frequent one is *Dermatodectes bovis.* Debility, poverty of condition and uncleanliness are predisposing causes. There is intolerable itching, the affected parts become sore, the hair falls off and the skin becomes thickened and drawn in folds or wrinkles. The parts primarily affected are the hump and the tail, from which the disease may extend to other parts. All animals affected should be carefully isolated. Wash them well with soap and water and then rub in ointment made up of sulphur four parts, linseed oil eight parts, turpentine two parts. Any of the antiparasitics given under Recipes may also be used. Give also internally once daily for a few days 2 ounces common salt and 4 ounces sulphur, mixed with food, or as a drench in a pint of water.

Lousiness.—This is very common in cattle, specially in animals in poor condition. Several different forms of lice are known to attack cattle. Dress with tobacco infusion or some other antiparasitic dressing mentioned under Recipes. The dressings require to be several times repeated and well rubbed in. The animals should be thoroughly washed an hour or two after each application.

Ringworm.—This is due to vegetable parasites—fungi—growing upon the skin. Two forms are known in cattle, *Tinea tonsurans* (common ringworm) and *Tinea favosa* (honeycomb ringworm). Round patches are formed devoid of hair and covered with a greyish, yellow scurf. Dress the affected parts with corrosive sublimate lotion or rub in red iodide of mercury ointment.

Foul.—An irritative inflammation and ulceration between the digits, usually caused by animals [standing] in a filthy wet yard or on soft, wet, marshy pastures. The treatment consists of the removal of the affected animals to a dry place. The feet must be washed with phenyle or carbolic lotion, and then dressed with tar mixed with a little powdered sulphate of copper.

Laminitis.—Inflammation of the sensitive structure of the foot. This complaint is not very frequent in cattle, but sometimes occurs in highly-fed animals : it may also be caused by overdriving. Working cattle are most liable. Some or all the feet may be affected. Give a cathartic, rest the

animal, and continuously apply cold water to the affected feet.

Conjunctivitis, Simple ophthalmia.—Results from injuries and from entry of foreign matter into the eye. The eye is red and congested, tears flow freely from it and the patient cannot bear exposure to the light. Seek and remove the cause. Then bathe the eye freely with cold water. Following this, put into the eye a few drops of alum or zinc or boric lotion (see collyria under Recipes). If any opacity of the cornea should result, dress the eye with silver nitrate lotion—5 grains to an ounce of water.

Worm in the eye.—The worm is *Filaria lachrymalis.* It does not, as in the horse, live within the aqueous chamber of the eye but on the surface of the cornea, and lodges at the inner angle under the haw. There may be one worm or several. The affected eye is partially closed and continually waters. Cast the animal and bathe the eye freely with cold water. The worms, if present, can be got at by lifting up the haw. They must be picked up with forceps and removed.

Paralysis.—This is characterized by total or partial loss of sensibility or motion or both in some part or parts of the body. The most usual form in which the disease is met with in cattle, is the affection of the hind quarters known as *paraplegia.* Causes are injuries to the spine, overloading (in pack bullocks), sudden changes of temperature and exposure to wet and cold. The animal is unable to move freely, and drags the hind quarters. The gait is unsteady and staggering. Give a purgative to clear out the bowels. Apply a blister of red iodide of mercury to the loins (see Irritants under Recipes) and give daily for about a month half a dram of powdered nux-vomica in food or as drench.

Milk fever: *parturient apoplexy*; *dropping after calving.*—A disease peculiar to the cow which occurs after calving and within 10 days of it. In rare instances it is seen during or immediately prior to the birth of the calf. The disease is one of the nervous system and induces a partial or total loss of power. It is due to the formation of a certain ferment or toxin (poison) in the udder, which is absorbed and causes this nervous disorder. It chiefly affects deep milkers, and one attack predisposes to a second. The animal has a wild look and the gait is staggering. It lies in a state of torpor and moans. There is no discharge of dung or urine. The mouth opens and saliva flows from it. If any gruel is given, it runs out of the mouth without the cow making any attempt to swallow it. The disease is very fatal. Its

duration is one or two days. Treatment should be prompt. Give a strong purgative—1½ lb. of Epsom salts with an ounce of aloes in two or three quarts of water. Copious warm enemas with castor oil or soap in them should be administered. Thin rice conjee or linseed tea should be given warm, and, if the patient does not take it, should be gently poured down the throat. The up-to-date treatment for milk fever is the injection of oxygen or atmospheric air or any antiseptic lotion into the udder through the teat after milking the cow thoroughly dry, with the necessary antiseptic precautions; this needs the attendance of a professional man. If the animal recovers, it must be kept for some time on digestible and laxative food, or better on a gruel diet with some green grass, and receive a course of tonics.

Fracture of the horn.—This often occurs from animals fighting or from an accident. The horn core may be fractured transversely without injury of the horn. The latter acts as splints, and no particular treatment is necessary beyond rest and a cold bandage round the horn. In some cases the horn alone is stripped off without the core being injured. In such cases clean the core gently with carbolic lotion and cover it with tarred tow and then with a bandage. When both core and horn are broken off, the rough projections and broken fragments of bone must be removed and sawn level. The bleeding may be stopped with a hot iron and the part dressed as above.

Sprain.—The muscles and tendons or ligaments of the joint of the leg may become sprained, and swelling, heat and pain of the affected part with lameness, may result. Foment the part with hot water till heat and pain pass off. Then keep a cold bandage on or make the animal stand in cold water for a couple of hours daily. If this does not complete the cure, and if any swelling still remains, rub in a blister of red iodide of mercury.

Mislocation or luration.—From accident or over-exertion, a bone may be put out of joint In working cattle the arm bone is perhaps the most frequently dislocated. The reduction is to be effected by casting the animal, and seizing the arm and pulling it downwards, when the bone may be heard to return to its socket with a snap. After this, rest and cold applications to the part are all that are necessary.

Wounds and tumours.—In case of injuries to the skin and in wounds generally, wash the parts with clean water freely,

and then dress them with some antiseptic dressing. See antiseptic recipes. The necks of working cattle are liable to be galled in various ways. In case of simple abrasion, the treatment is the same as for wounds. If the neck be inflamed and swollen, foment with hot water twice daily for two or three days, after which apply cold water freely and frequently. Should any swelling still persist, blister the part with mercury or mylabris ointment. Sometimes an abscess may form, which must be opened and the contents removed and the part treated as a wound. If there be any longstanding cold and well circumscribed tumour, it should be dissected out surgically.

Abortion; Miscarriage.—Abortion may happen at any period between the first and the seventh month of pregnancy. If it occurs after the seventh month, it is called miscarriage and the young animal is born alive and is able to live for a longer or shorter period. Some of the causes of abortion are injuries, fright or excitement, over-driving, the presence of fungi on the fodder, exposure to cold, debility, etc. Pregnant animals affected with blood diseases generally abort. Sometimes abortion is due to bacterial organisms and in such cases it may rage as an enzootic. In every case the safest plan is to segregate the cow that has aborted, to bury the calf and the cleansing deeply in the ground and to disinfect the stall. The animal should be nursed and carefully watched. As a rule, the fœtal membranes are passed investing the fœtus but if not and if they are retained unduly long, they should be removed with the hand. An aperient of Epsom salts should be given to the cow. Cows that have once aborted are liable to do so at about the same stage during future pregnancies.

Retention of after-birth or placenta.—The placenta comes away from ½ to 4 hours after the birth of the calf. The cow must be watched till the after-birth drops, when it should be removed and buried. Sometimes the placenta is retained for several days without any constitutional disturbances being set up. There is no danger whatsoever in allowing it to remain for two or three days. If it is retained beyond this, it may be removed with the hand. The practice of removing the placenta forcibly when it is retained a little beyond the usual time is to be condemned.

Inversion of the womb; Downfall of the calf bag.—This may occur after calving, specially when there has been difficult labour. After the calf is born, the cow continues to strain until the uterus is forced out. Administer a dram of ganja or of opium in gruel to quiet the animal, and make it stand with

the hinder parts elevated. The uterus should be carefully washed with warm water containing a small quantity of carbolic acid or some other antiseptic. The closed fist should then be applied to the fundus of the organ, which must be gradually and gently pushed inwards. Stitches may be passed through the lips of the vulva to keep the uterus in its place. The stitches can be left for about 24 hours or until all straining has stopped. In some cases, a truss made of rope can be arranged so that it will press against the vagina.

Mammitis; *Garget*; *Downfall of the udder*.—Inflammation of the mammary gland is frequent in the cow. Exposure to cold, injuries of various kinds, obstruction of the flow of milk, allowing the animal to remain too long without milking may be enumerated as causes. Foot-and-mouth disease and cow-pox may also induce the disease. Mammitis often occurs soon after parturition and is caused by sudden overdistention of the part from a rush of new milk. The udder becomes enlarged, hot and tender and pits on pressure. The calf should be put to the mother frequently and the milk drawn away gently, so that the udder may be emptied. The part should be fomented with warm water freely two or three times a day and dressed with camphor oil after each fomentation. The patient should have a pound of Epsom salts given in warm water. The udder can be supported with a broad bandage. Abscesses should be looked for and at the first indication they should be opened, the matter let out and the opening dressed with carbolic oil.

Sore-teats.—This, like garget, often occurs after calving. Cracks and sores form on the teats causing much uneasiness when the cow is milked. Before milking, foment the teats with warm water, in which some alum has been dissolved. After milking dress the teats with boric liniment made in butter, ghi or coconut oil.

Navel-ill.—Occasionally calves suffer from this owing to the abrupt or imperfect separation of the navel cord, and the navel bleeds. Should the cord be of sufficient length, it may be ligatured, but if close to the abdomen, apply a little powdered sulphate of copper or touch it with the point of a heated iron. Sometimes an abscess may form, which must be opened at once and dressed with carbolic oil. An abscess may lead to inflammation of the peritoneum and occasion the death of the calf.

Costiveness in the newly born calf.—The best medicine is the cow's first milk. If there is any necessity for an aperient being given, administer in half a pint of rice gruel 2 ounces of castor oil with half a dram of ginger powder.

Scour ; Diarrhœa in calves.—This is caused by indigestion brought on by repletion. At other times the disease may be produced by the free eating of young tender grass. Starvation or want of sufficient nourishment may also induce the disease. The first thing to do is to administer a mild aperient —2 ounces of castor oil in half a pint of gruel. Then put the calf on a course of some cordial like the following—powdered chalk 2 ounces, powdered catechu 1 ounce, powdered ginger ½ ounce, ginger 1 dram, infusion of coriander 1 pint; dose, 1 to 2 ounces, 2 or 3 times a day.

The Sheep.

The sheep is a mammal belonging to the order *Ungulata*, group *Ruminantia*, family *Ovidae*, genus *Ovis* and species *Ovis aries*.

The chief breeds of Southern India are—

The Madras or South Indian.—This breed is found over the whole Presidency. The sheep have tucked up bellies, light feet, bony limbs, flat sides and short tail. Only the rams have horns. They are covered with short coarse hair, whose colour is generally red or brown. They have, as a rule, a couple of pendulous lobules hanging from the throat, known in Tamil as 'Munnies,' that is, bells.

The Nellore.—The sheep are large in size and about the tallest in India. The average live weight of adult animals is 80 to 100 lb. The rams have twisted horns. The ewes are hornless. The prevailing colour is white or a light brownish-white. The body is densely covered with short hair.

The Coimbatore.—This district has, in addition to the Madras breed, a breed of wool-producing sheep. The prevailing colour is white with a black head, sometimes also black neck. The sheep have a fine covering of wool. They have good square compact carcases. They fatten rapidly, and they yield mutton of a superior quality. Full grown animals weigh from 50 to 60 lb.

The Mysore.—This province is noted for a woolly breed of sheep. The rams have well twisted horns but the ewes are, as a rule, hornless. The usual colour is a light to a dark grey or black. Live weight of adult animal is 40 to 60 lb. They are not unlike the Coimbatore in point of build and size. The sheep of this breed are prone to pugnacity, and furnish the chief fighting rams in Southern India. The breed has been improved from time to time by being crossed with Merino rams.

Patna in Bengal is noted for a breed of woolly sheep of good size and form and yielding very good mutton. Some rams of this breed were imported in the Government Farm, Saidapet, and they throve remarkably well and stood the hot weather much better than the Nellore, which were present in the flock at the time.

Names of Sheep.

Male.

Until weaned, suckling. After weaning until a year old, ram lamb; if castrated, a wether. Afterwards, a two-year ram or wether, a three-year ram or wether and then an aged ram or wether.

In the case of woolly sheep, the ram lamb when shorn at the end of the first year becomes a shearling, then a two-shear ram, then a three-shear ram and then aged.

Female.

Until weaned, suckling. Until a year old, ewe lamb. After a year old until it drops a lamb, a gimmer; if in lamb, gimmer in lamb, if not, barren gimmer, if not put to the ram, a yeld gimmer. After a gimmer has lambed, she is called an ewe, two-year, three-year, aged.

In the case of woolly sheep, the terms used are the same as those for rams, namely shearling ewe, two-shear ewe, three-shear ewe, aged ewe.

Breeding and Rearing.

Sheep are bred in India for mutton alone or for mutton and wool. The wool should be fine and long and free from hair. The ewes kept for breeding should be carefully selected. They should have a good conformation and, in the case of woolly sheep, a good fleece, especially over the belly. They should be between 1 and 3 years old. Old and ill-formed and defective animals should be weeded out from the flock. One ram will suffice for 50 ewes. The breeding rams are allowed to run with the ewes always. Under these conditions, all over Southern India, generally, the ewes take the ram from February to March and the lambs are dropped from July to August. The average period of gestation in

sheep is 150 days or roughly 5 months. The lambs can be weaned when 3 to 6 months old. Rams are not castrated until they are about a year old, but lamb castration performed a fortnight or a month after birth is probably desirable. The weight of a lamb at birth is about one-twelfth of the weight of the dam. A sheep attains its full growth and weight at the age of three years. About two-thirds of the weight is attained in the first year and the greater part of the remainder during the second year.

Feeding.—The sheep are fed on pastures only and are kept out in the open air all the year round. In the hot weather when the pastures are bare, the animals fall in condition considerably. No provision of any artificial food or of any fodder, green or dry, for such seasons is made.

Shearing.—In India the sheep are clipped once yearly either in the hot and dry part of the year, April to May, or in the cold dry season, January to February. They are clipped for the first time when they are a year old. The sheep are washed generally before they are shorn. The washing is done on the same day or the day before.

Dentition.—The dentition of the sheep resembles that of cattle as to the number of teeth and their position. The teeth of the sheep are also similar to those of cattle but much smaller. As in cattle, the front part of the upper jaw has no teeth and has, in their place, a dense fibrous pad. There are two sets of teeth, milk and permanent. The milk set consists of eight incisors in the front part of the lower jaw and three molars (known as premolars) on each side of each jaw, that is 20 in all. All these are replaced later on by permanent teeth and three more molars on each side of each jaw behind the premolars come up once for all, so that the total number of permanent teeth is 32.

Dental formula for milk teeth.

Incisors $\frac{0-0}{4-4}$, premolars $\frac{3-3}{3-3}$. Total 20.

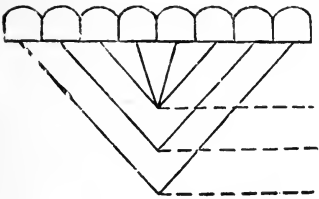
Dental formula for permanent teeth.

Incisors $\frac{0-0}{4-4}$ premolars $\frac{3-3}{3-3}$, molars $\frac{3-3}{3-3}$. Total 32.

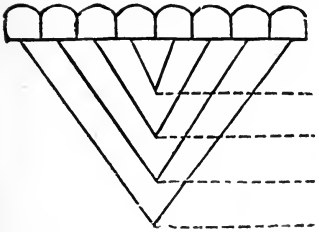
Note.—The top figures in each formula show the teeth on each side of the upper jaw, and the bottom figures, the teeth in the lower jaw.

Teeth indicating age.

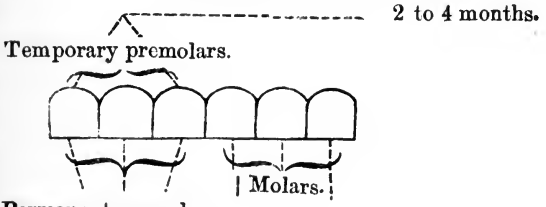
(Appearance of temporary incisors.)



(Appearance of permanent incisors.)



(Appearance of molars.)



Lambing Table.

Average period of gestation, 150 days.

If served on	Will lamb about	If served on	Will lamb about
January 1	May 31	July 1	November 28
„ 14	June 13	„ 14	December 11
February 1	July 1	August 1	„ 29
„ 14	„ 16	„ 14	January 11
March 1	„ 29	September 1	„ 29
„ 14	August 11	„ 14	February 11
April 1	„ 29	October 1	„ 28
„ 14	September 11	„ 14	March 13
May 1	„ 28	November 1	„ 31
„ 14	October 11	„ 14	April 13
June 1	„ 29	December 1	„ 30
„ 14	November 11	„ 14	May 13

Common Diseases

Foot-and-mouth disease—Epizootic aphtha.—(See the description under cattle.) In sheep the feet are chiefly affected and the mouth seldom. Some of the milder applications mentioned under antiseptics (see Recipes) may be used. The disease is infectious and contagious but causes little mortality.

Sheep-pox—Variola ovina.—A formidable and highly fatal disease in sheep, infectious and contagious. First, reddish spots appear on the naked places, which then turn into red or purple circumscribed vesicles, which often run into each other. Treatment is of no avail. Every attempt should be made to suppress the disease and dead animals should be buried deep with quicklime.

Rinderpest.—(See the description under cattle.) This is also a highly infectious and fatal disease. In virulent outbreaks, 80 per cent may die. There is fever, blisters in the mouth and bloody diarrhœa. Preventive measures should be adopted and dead animals should be buried in deep pits with quicklime.

Anthrax.—In sheep, it runs the same course as in cattle (see above) and is highly fatal.

Treatment.—5 to 10 minims of carbolic acid in three to four ounces of linseed oil may be given. Precautionary measures such as segregation and disinfection should be adopted as mentioned in the case of cattle. This disease should not be confused with Braxy.

Scrofula Tuberculosis.—A specific disease and somewhat infectious. The respiratory organs are often affected, sometimes the abdominal organs. It is very liable to appear in animals which are inbred and which are in a fat condition. There is slow fever and the animal pines away. An attack of diarrhœa carries off the animal in the end. The best thing is to slaughter the animal as soon as the symptoms are noticed. If the disease has not made much progress, the flesh can be eaten well boiled.

Rabies.—Hydrophobia.—This is produced by the bite of a rabid dog or jackal. After a varying period of incubation after the animal has been bitten, it begins to behave strangely and butts other sheep furiously. The breathing becomes hurried and saliva flows freely from the mouth. The patient dies within a week. There is no treatment and a rabid sheep should be destroyed at once. Should there be suspicion that a sheep has been bitten by a rabid animal, the best thing is to kill it forthwith. The mutton can be used well cooked.

Contagious footrot.—This is a specific disease. The hoof softens and loosens from the tissues inside. There is suppuration and fungoid growth on the coronet. Fortunately this disease is rare. Make a solution of carbolic acid or of sulphate of copper in a large tub and dip the feet of the affected sheep once daily.

Catarrh or cold.—A very common complaint during wet and cold weather. There is slight cough and copious discharge of mucus from the nostrils. The patient may also be feverish. Rest and quiet is all that is necessary. A couple of ounces of Epsom salts with half a dram of powdered ginger may be given as a drench in half a pint of water.

Bronchitis.—This may be the result of a neglected catarrh or may originate from the same causes as catarrh. There is severe cough and profuse discharge from the nostrils. The appetite is lost, the breathing is hurried and the bowels are costive. Fever is generally present at the commencement. Give once daily for two or three days an ounce of Epsom salts, a dram of nitre and half a dram of ginger powder in half a pint of warm water. In severe cases, rub some stimulating liniment or turpentine on the throat.

Pneumonia—Inflammation of the lungs.—This is a dangerous disease in sheep. There is fever, hard breathing, much

cough and some mucous discharge from the nostrils. Rumination is suspended and food is refused. There is heaving of the flanks and a staggering gait. The disease may prove fatal in a couple of days. Treat in the same way as bronchitis. Rub in powdered mustard or turpentine over the throat and chest until the parts are slightly blistered.

Aphtha.—This sometimes breaks out in a flock, as a rule in the cold weather. Lambs and young sheep are chiefly affected. The disease is probably contagious. There is a dense crop of warty growths on the lips and the muzzle. They soon become ulcerated and fungoid and run into each other. Mortality, however, is not marked. Wash the parts once daily with carbolic lotion and then dress with boric ointment.

Hoven—Tympanitis—Distention of the rumen with gas.—It is generally caused by the consumption of young succulent grass. There is swelling on the left side of the belly, which when struck sounds like a drum. The patient evinces uneasiness and pain. Give at once in half a pint of warm water, Epsom salts 3 ounces, ginger 2 drams and slaked lime 20 grains.

Diarrhœa.—This may arise from the same causes as tympanitis or from a change of pasture or from change of weather. There is excessive purging, loss of flesh and weakness. Give shelter and dry nourishing food. Change pasture, if possible. Give repeated doses of some cordial (see Recipes) or the following twice daily for a couple of days : Powdered gallnut half a dram, powdered omum half a dram, chalk or slaked lime 20 grains, powdered ganja 10 grains, in half a pint of warm gruel or infusion of linseed.

Dysentery—Bloody flux.—This is inflammation of the mucous membrane of the intestines. This is a much more dangerous and fatal disease than diarrhœa. There is sometimes an outbreak of dysentery in a flock, which is probably a contagious form of the disease. There is fever, the stools become frequent, are mixed with blood and slime and are voided with pain and straining. Give once daily for a couple of days 2 ounces of castor oil with 10 grains of powdered ganja in half a pint of warm gruel. Should the purging continue after this, give catechu half a dram, powdered ginger half a dram, chalk one dram, in half a pint of warm infusion of linseed once daily.

Rot—Liver Rot.—This is very destructive disease. It sometimes breaks out in a flock during the hot weather. It is due to the presence of flukes—*Distoma* or *Fasciola hepatica*—in the substance of the liver, gall-bladder and biliary

ducts. Sheep infested with the fluke lose flesh gradually. The eyes are dull and tinged yellow. The bowels are costive at first but, later, violent purging begins and the fæces are fetid and tinged with blood. Dropsy sets in and is particularly marked as a swelling under the jaw, and the disease terminates generally fatally, from three to seven days. After this, treatment should, if possible, consist in the removal of the flock to an open dry pasture. The animals should have a little cake in addition to grazing. Common salt and sulphate of iron powdered may be given mixed with cake or as a drench at the rate of 1½ drams of common salt and half a scruple of sulphate of iron per adult head.

Tetanus, Trismus or lock-jaw, is an infectious disease which may attack the ox but more commonly sheep and goats. It is caused by the Tetanus bacillus which infects wounds and casues a general poisoning of the nervous system. Tetanus is of two kinds: Traumatic and Idiopathic. In the former the wound is seen anywhere over the body, in the latter the wound or abrasion is believed to be either in the mouth or in the alimentary tract. The period of incubation is two or three days. The animal is nervous and excitable with rigidity of the muscles of the neck. There is quivering, stiffening and elevation of the tail. There is also fever with excessive thirst. The symptoms increase in one, two or three days. All the muscles of the head and neck gradually become stiff, the nose is poked forward, the nostrils dilated and the haw of the eye protruded. The jaw is fixed, and there is complete loss of power to masticate. The animal stands stiff with the fore legs propped out for support and when it moves the legs appear to be jointless. As the disease progresses there is general rigidity of the muscles and the animal falls down with spasms, and, unable to get up struggles till death.

Treatment.—In the early stages before the lower jaw gets fixed, give a strong purgative. Four ounces of Epsom salt, two drops of croton oil and a dram of ginger in half a pint of water may be given and subsequently administer on the following days sedatives such as ganja, opium, belladona or chloral hydras. in ten grain doses mixed with a little jaggery or honey and rubbed on the tongue and palate twice daily. Careful nursing is necessary. The animal should be kept as quiet as possible and in a dark but well-ventilated shed. The wound, if any, should be thoroughly cleansed with strong antiseptic lotion and touched with pure carbolic acid or silver nitrate. Soft liquid food should be given.

Scab.—This is a contagious skin disease due to the ravages of a minute acarus—*Acarus ovis* or *Dermatodectes ovis.* The disease is known by the following symptoms : The animal shows uneasiness, wool comes away in locks and the parts denuded of wool exhibit pustules. The patient attempts to bite or strike with the feet the parts diseased, and rubs itself against a tree, stone or any other hard object. The affected sheep should be well washed with soapnut powder and water daily. Occasionally, about half an hour before washing, they may be dressed with an infusion of tobacco—half a pound of tobacco to 4 gallons of water. This should not be repeated too often, as tobacco is liable to be absorbed and to kill the patient. Any of the antiparasitic lotions given under "Recipes" may also be used. Salt should be placed before the animals to lick at pleasure.

The Gad fly.—A species of the gad fly, *Oestrus ovis,* infests sheep and deposits its ova about the nose and the lips. The larvæ, when hatched, creep into the nostrils and make their way up into the frontal sinuses, where they remain for about a year feeding upon the mucus. The maggots do not cause any irritation unless they are in large numbers. No treatment is necessary, and it is not possible to find out the affected animals.

Lousiness.—The sheep louse is *Hippobosca ovina.* It is generally associated with scab. Treatment is the same as that for scab.

Ticks.—Sheep are sometimes infested with ticks. There are species peculiar to the sheep, but dog ticks may also attack them. Ticks prefer the ears and the region of the neck and shoulders. When lambs are infested, they suffer much and their growth is arrested. Sponge the affected parts with tobacco infusion and then dress them with lamp oil.

Flies.—Many of the Muscidæ, particularly the Bluebottle fly, *Musca vomitoria,* and the Flesh fly, *Musca cæsar,* are very troublesome to sheep. They attack any part that may have a small abrasion or sore, and deposit eggs thereon. The larvæ familiarly known as maggots, are soon hatched and they infest the sores and eat into them. Dress the sores with a saturated solution of camphor in oil, to which a little kerosene oil may be added.

Abortion.—This is not at all uncommon in ewes and is brought about by various causes. No particular treatment is necessary. Placing the ewes for a few days in a sheltered place and nursing them will suffice.

Garget or Inflammation of the udder.—This is of frequent occurrence. Exposure to wet and cold, moisture and filth in the places where sheep lie down, wounds and injuries to the udder are amongst the causes. The udder becomes hot, hard and tender. Foment frequently with warm water and empty the udder of milk.

Recipes.

The recipes given below are for cattle and buffalos and the doses put down are for adult animals of those species, that is, those that have cut the first pair of teeth. For younger animals, the doses should be proportionately reduced. For calves under 6 months give one quarter of the adult dose. Many disorders are common to cattle, sheep and goats and in such, the same recipes may be employed for sheep and goats, the dose not being greater than that specified above for calves.

Alteratives and tonics.—Useful in debility, anæmia, during convalescence from debilitating disorders and in poverty of condition. To be given once daily for a week or more.

Drench—

(1)	Sulphate of iron	2 drams.
	Ginger, powdered	½ ounce.
	Chirata „	1 ounce.
	Warm water or gruel	1 pint.

Drench—

(2)	Sulphate of copper	1 dram.
	Nux-vomica, powdered	1 scruple.
	Coriander	½ ounce.
	Warm water or gruel	1 pint.

Powder or drench—

(3)	Sulphate of iron	1 dram.
	Nux-vomica, powdered	1 scruple
	White arsenic	3 grains
	Fenugreek, powdered	½ ounce.
	Aniseed	½ ounce.

Mix and give in food or as drench in a pint of water. This last recipe is very good when an animal is out of condition.

Anthelmintics, vermifuges.—These are given when an animal is suffering from worms. Begin with a strong

purgative (see purgatives), then give once daily for a fortnight the recipe No. 3 under 'alteratives' or the following :—

Powder—

Sulphate of iron	1 dram.
Sulphur	4 drams.
Sodium chloride	4 drams.

Mix and give in food.

Anæsthetics.—General and local anæsthesia is difficult to produce in ruminants and is seldom necessary.

General, to be given by inhalation—

(1) Chloroform or ether	4 to 6 ounces.
(2) Chloroform	3 ounces.
Ether	3 ounces.

Local, chiefly for the examination of, and operations on, the eyes.

(3) Cocaine	1 part.
Distilled, rain, or soft clean water ...	20 parts.

Antipyretics, febrifuges.—These lower the temperature of the body in fevers.

(1) Give a saline purgative (see purgatives) and nitre in drinking water.

(2) Drench—

Magnesium sulphate	3 ounces.
Nitrate of potash	½ ounce.
Water	1 pint.

Give twice a day for 2 or 3 days.

Antiparasitics.—Useful in mange, lousiness, and against ticks.

Lotion—

(1) Carbolic acid or phenyle	1 part.
Water	50 to 80 parts.
(2) A strong decoction of margosa or nux vomica leaves.	
(3) Tobacco leaf	½ ounce.
Water, hot	1 pint.
(4) Perchloride of mercury	1 part.
Water	...500 parts.

N.B.—The last two must be employed with great caution especially when they are applied to the whole, or a large part of the body, as these drugs are liable to be absorbed and to endanger the life of the patient. Within three hours of the dressing, the animal should be washed with water and the application should not be repeated before the lapse of a week.

Liniment—

(5) Camphor ... ... 1 part.
Margosa oil ... ... 10 parts.
Coconut oil ... ... 20 parts.

Ointment—

(6) Carbolic acid ... ... 1 part.
Sulphur, sublimed or powdered ... 2 parts.
Lard ... ... 6 parts.

Antiseptics—

Internal, given in indigestion, tympanitis, etc.

Drench—

Carbolic acid ... ... 1 fluid dram.
Linseed oil ... ... 1 ounce.
Gruel ... ... 1 pint.

External, for wounds, ulcers, etc.

Lotions—

(1) Carbolic acid or phenyle ... ... 1 part.
Water ... ... 20 to 40 parts.
(2) Boric acid ... ... 1 part.
Water (hot preferable) ... ... 20 parts.
(3) Permanganate of potash ... ... 4 grains.
Water ... ... 1 ounce.
(4) Perchloride of mercury ... ... 2 grains.
Water ... ... 1 ounce.

Liniments—

(5) Carbolic acid ... ... 1 part.
Coconut oil ... ... 10 to 12 parts.
(6) Iodoform ... ... 1 part.
Carbolic acid ... ... 1 part.
Turpentine ... ... 2 parts.
Camphor ... ... 1 part.
Tobacco snuff ... ... ½ part.
Coconut oil ... ... 20 parts.

N.B.—A very good detergent for foul wounds infested with maggots.

Powders—

(7) Iodoform ... ... 1 part.
Boric acid ... ... 2 parts.
(8) Chalk ... ... 15 parts.
Carbolic acid ... ... 1 part.

Ointments—

(9) Carbolic acid ... ... 1 part.
Lard ... ... 8 parts.
(10) Boric acid ... ... 1 part.
Lard ... ... 4 parts.
(11) Common tar, Resin, Lard } Of each equal parts.

N.B.—Melt and mix over a gentle fire. Useful in footrot in sheep, and in foul in cattle.

Astringents—

Internal, for diarrhœa, dysentery, etc.

Drenches to be given twice daily—

(1) Gallnut, powdered ... ... 3 drams.
Chirata, powdered ... ... 4 drams.
Fenugreek, powdered ... ... 4 drams.
Gruel ... ... 1 pint.
(2) Catechu, powdered ... ... 2 drams.
Camphor ... ... 2 drams.
Bael fruit, powdered ... ... 4 drams.
Gruel ... ... 1 pint.
(3) Decoction of the leaves and the rind of the fruit of the pomegranate tree.

External, for wounds and ulcers, and for stopping capillary bleeding.

Lotions—

(1) Alum, or zinc sulphate or sulphate of copper ... ... 1 ounce
Water ... ... 6 to 10 ounces

Powders—

(2) Alum, Sulphate of iron, Sulphate of zinc } Of each equal parts.
(3) Galls, powdered, Catechu } Of each equal parts.

Collyria or eye washes useful in conjunctivitis :—

(1)	Alum or sulphate of zinc or sulphate of copper	5 to 10 grains.
	Water	1 ounce.
(2)	Alum	5 grains.
	Zinc sulphate	5 grains.
	Boric acid	10 grains.
	Water	1 ounce
(3)	Silver nitrate	5 to 10 grains.
	Water	1 ounce.

Note.—5 to 10 minims of tincture of opium may be added to each of the above as an anodyne.

Gargles in simple and epizootic aphtha, for wounds in the mouth, etc. :—

(1)	Boric acid	20 grains.
	Water	1 ounce.
(2)	Alum	15 grains.
	Water	1 ounce.
(3)	Permanganate of potash	4 grains.
	Water	1 ounce.

Cordials and stimulants—useful in indigestion, flatulency and tympanitis :—

Drenches—

(1)	Ginger, powdered	4 drams.
	Cumin	4 drams.
	Asafetida	2 drams.
	Water	1 pint.
(2)	Ammonium carbonate	2 drams.
	Nux-vomica, powdered	½ dram.
	Water	1 pint.
(3)	Solution of ammonia	1 ounce.
	Turpentine	2 ounces
	Aniseed, powdered	4 drams.
	Water	1½ pints.

Very strong and efficacious in tympanitis.

Disinfectants.—Internal, given as curative and preventative in specific blood diseases.

Recipes given under 'Antiseptics internal' may be employed.

External, for disinfecting cattle sheds, sheep pens and contaminated articles—

(1) Freshly slaked lime ... ... 100 parts.
Carbolic acid ... ... 15 parts.
Mix thoroughly and sprinkle :
(2) Carbolic acid ... ... 3 ounces.
Water ... ... 1 gallon.
(3) Perchloride of mercury ... ... 1 ounce.
Water ... ... 1 gallon.
(4) Permanganate of potash ... ... 1½ ounces.
Water ... ... 1 gallon.
(5) Chlorine gas and sulphur anhydride are very useful disinfectants.
(6) A good fire is the best disinfectant. All contaminated straw, litter, etc., should always be burnt.

Diuretics.—These increase the secretion of urine and are indicated in dropsical swellings, in fever and in dysuria.

Drenches—

(1) Nitrate of potash ... ... 3 drams.
Resin, powdered ... ... 3 drams.
Turpentine ... ... 2 drams.
Water ... ... 1 pint.
(2) Magnesium sulphate ... ... 3 ounces.
Nitrate of potash ... ... ½ ounce.
Water ... ... 1 pint.

Demulcents and emollients.—These soften and soothe the parts to which they are applied.

Demulcents (internal).—Bland oils, linseed tea, gruel.

Emollients (external).—All non-irritating oils and fats, starch, powdered chalk, etc.

For burns and scalds, a very efficacious application is carron oil, prepared as follows :—

Solution of lime
Coconut oil } of each equal parts.

Ecbolics-parturients.—These make the womb contract and expel its contents.

Powder or tincture or extract of ergot. 1 ounce.
Asafetida ... ... 2 drams.
Water ... ... 1 pint.

Expectorants.—These remove phlegm from the air passages and are given in cough, catarrh and lung affections.

Drenches—

(1) Ammonium carbonate ... ... } of each 2 drams.
Asafetida ... ... }
Camphor ... ... }
Water .. .. 1 pint.

(2) Opium ... ... 1 dram.
Camphor ... ... 2 drams.
Turpentine ... ... 1 ounce.
Water or gruel ... ... 1 pint.

Irritants.—These are employed externally for counter-irritation in cases of sprains, sore-throat and inflammatory affections of the internal organs; as stimulants, detergent and caustic to unhealthy sores and ulcers; for bringing about absorption of bony tumours, enlarged glands and thickened integuments, and for ringworm.

Liniments—

(1) Solution of ammonia ... ... 1 ounce.
Turpentine ... ... 1 ounce.
Coconut oil ... ... 2 ounces.

(2) Mylabris, powdered ... ... 1 ounce.
Coconut oil ... ... 8 ounces.
(Digest over a hot bath.)

(3) Mustard, powdered ... . 4 ounces.
Turpentine ... ... 5 ounces.
Coconut oil ... ... 5 ounces.

Ointment—

(4) Mylabris in powder ... ... 1 part.
Lard ... ... 6 parts.

(5) Red iodide of mercury ... ... 1 part.
Lard ... ... 8 parts.

For bites of venomous reptiles and rabid animals apply immediately to the part undiluted carbolic acid or some other strong caustic.

Purgatives—

Mild—

Drenches—

(1) Magnesium sulphate ... 12 to 16 ounces.
Ginger, powdered ... ... ½ ounce.
Water... ... ... 2 pints.

(2) Sodium chloride ... ... 1 lb.
Omum powdered ... ... ½ ounce.
Water ... ... 2 pints.

(3) Castor oil or linseed oil ... ... 2 pints.
Infusion of ginger (1 ounce). ... 10 fluid ounce.

Strong—

Drenches—

(1)	Magnesium sulphate	1 lb.
	Aloe, powdered	1 ounce.
	Ginger	½ ounce.
	Water	2 pints.
(2)	Magnesium sulphate	1 lb.
	Gamboge, powdered	½ ounce.
	Aniseed	½ ounce.
	Water	2 pints.
(3)	Castor oil or linseed oil	2 pints.
	Croton oil	30 minims.
	Infusion of ginger	10 fluid ounces.

Weights and Measures and other Substitutes used in Veterinary Practice.

[Solid medicines are weighed. Liquid medicines are generally measured but may also be weighed.]

Solids.

60 grains	... =	1 dram or drachm.
8 drams	... =	1 ounce.
16 ounces	... =	1 pound.
1 scruple	... =	20 grains.
1 viss = 40 palams	=	3 pounds, 2 ounces = 120 tolas.
1 pound	... =	$38\frac{2}{5}$ tolas.
1 palam	... =	3 tolas = 1 ounce, 2 drams.
1 tola ...	... =	$3\frac{1}{3}$ drams.

Liquids.

60 minims	... =	1 fluid dram.
8 fluid drams	... =	1 fluid ounce.
16 fluid ounces	.. =	1 fluid pound.
1 pint	... ... =	20 fluid ounces.
1 gallon = 8 pints	=	160 fluid ounces = 10 fluid pounds.
1 Madras measure	=	$62\frac{1}{2}$ fluid ounces.

A bottle contains 20 to 25 ounces.

Medicinal Substances and Instruments which a Farmer should always have at hand.

Medicinal Substances.

Aloe.
Alum.
Arecanuts.
Asafetida.
Bicarbonate of soda.
Boric acid.
Camphor.
Carbolic acid, phenyl, cyllin or cresol.
Castor oil.
Catechu.
Chirata.
Coconut oil.
Croton oil.
Gallnuts.
Ganja.
Ginger.
Iodoform.
Sulphate of copper (blue stone).
Sulphate of iron.
Linseed ; linseed oil (raw).
Liquor ammoniæ.
Mylabris.
Nux vomica.
Omum.
Perchloride of mercury.
Permanganate of potash.
Red iodide of mercury.
Saltpetre (nitre).
Slaked lime or chalk.
Sulphate of magnesia (Epsom salts).
Sulphate of zinc.
Sulphur.
Turpentine.
Tar.

Instruments and Appliances.

Dressing instruments :—Forceps, seton needles, suture needles, probe, a couple of scalpels, scissors.
Trocar and canula for tympanitis.
Enema funnel.
Firing irons.
Shoeing tools—drawing knife, pincers, buffer and hammer.
Castrating clamps.
Teat bistoury.
Probang or a piece of smooth flexible rattan about 6 feet long.
Drenching horn or bamboo or bottle.
Clinical thermometer.
Syringe.
A big knife for *post-mortem* examination.
Lint, tow, cotton and suture thread.

Periods of gestation of domestic animals and of incubation of poultry.

Animals.	Shortest period.	Average or usual period.	Longest period.
	DAYS.	DAYS.	DAYS.
Mare	315	345	360
Ass	365	380	391
Cow	242	285	313
Buffalo	290	310	330
Ewe	145	150	160
Goat	148	155	165
Sow	109	115	143
Bitch	55	60	63
Cat	48	50	56
Rabbit	25	30	35
Hen sitting on hen eggs ...	19	21	23
„ duck eggs ..	28	30	32
„ turkey eggs.	26	28	30
Duck	28	30	32
Goose	27	30	33
Pigeon	18	20	21

Number of Females to each Male.

Mares	60
Cows and buffalos	50
Ewes	50
Goats	20
Sows	10
Hens	10
Ducks	10
Turkeys	8
Geese	4

PERIODS OF HEAT (OESTRUM).

Animal.	Duration of heat.	First heat after birth of young.	Recurrences of heat.
Mare ...	5 to 7 days.	10 to 15 days ...	2 to 3 weeks.
Cow ...	1 to 2 „	1 to 3 months and more.	2 to 4 „
Buffalo ...	1 to 3 „	2 to 3 months and more.	3 to 4 „
Ewe ...	1 to 2 „	2 to 6 months ...	2 to 3 „
Goat ...	1 to 2 „	1 to 3 „ ...	2 to 3 „
Sow ...	2 to 4 „	5 to 6 weeks ...	2 to 3 „

PULSE, RESPIRATION AND TEMPERATURE.

Animal.	Pulse.		Respiration per minute.	Temperature F.
	Beats per minute.	Where felt.		
Horse ...	35—45	Jaw ...	10—12	100—101
Cattle ...	50—60	Tail and jaw ; in calves, arm and thigh also.	16—24	100·5 101·5
Buffalo ...	45—56	Tail and jaw ...	20—25	100—101
Sheep ...	60—80	Arm and thigh ...	30—40	102—104
Goat ...	60—70	Do. ...	25—30	101—103
Pig	70	Heart ...	15—25	102·5

The above figures are the average for adult animals while at rest. There are considerable individual variations and, consistently with health, variations in the same animal at different times and under different conditions. For instance, in sheep the number of respiratory acts may run up considerably on account of excitement or atmospheric temperature. In the young animal respiration is quicker and temperature slightly higher than in the adult. Exercise and digestion increase temperature and respiratory acts.

Disinfection.

An infected building is best disinfected with sulphur burnt inside, the doors and windows being closed. Cattle sheds can be disinfected with a 5 per cent solution of carbolic acid or a ½ per cent solution of corrosive sublimate or 1 per cent solution of permanganate of potash. All the wood work should be sponged with the solution and all corners and crevices should be well damped with it. Gutters should be flushed with the disinfectant lotion. If the floor be of mud, some litter may be burnt on it, and then it should be sprinkled with quick or freshly slaked lime, to which some carbolic acid may be added. Finally, the walls should be lime-washed, a little carbolic acid being added to the wash. See "Disinfectants" under "Recipes."

Life of Animals.

	Years.
Horse	35
Ass	30
Cattle	20
Buffalo	25
Sheep	10
Goat	15
Pig	20
Cat	12
Dog	12
Hare	7
Rabbit	7
Hen	14
Goose	80
Camel	60
Elephant	150

LIST OF THE PRINCIPAL ANIMAL AND VEGETABLE PARASITES.

Scientific name.	Common name.	Attack.
Sub-kingdom, Vermes.		
Class, Platyhelmia (flat worms).		
Order, Cestoda or Tæniada (tapeworms).		
Cysticercus Cellulosus.	'Measles' in pork.	Muscles of the pig. Becomes common or armed tapeworm (*Tænia Solum*) in man.
Cysticercus sp.	'Measles' or 'Bladder worm' of the ox.	Muscles of the ox. Becomes unarmed tapeworm (*Tænia saginata*) in man.
Cœnerus Cerebralis ...	'Sturdy' in sheep.	Brain of the sheep. Becomes tapeworm (*Tænia cœnurus*) in dog.
Tænia expansa ...	...	Tapeworm in the ox, sheep and goats.
Order, Trematoda (flukes).		
Fasciola or *Distoma hepatica.*	'Fluke'—'rot'—'liver rot.'	Liver, gall bladder and biliary ducts of sheep.
Class, Nemathelmia (round worms).		
Order Nematoda.		
Trichina spiralis ...	Flesh worm...	Muscles of man, pig, etc., causes trichiniasis.
Strongylus filaria] ...	'Husk' in lambs.	Trachea and bronchial tubes of lambs.
Strongylus micrurus ...	'Husk' in calves.	Trachea and bronchial tubes of calves.

LIST OF THE PRINCIPAL ANIMAL AND VEGETABLE PARASITES – *cont.*

Scientific name.	Common name.	Attack.
Strongylus contortus or Strongylus cervicornis.	'Lamb disease.'	Fourth stomach of lambs. Causes gastro-enteritis.
Oxyrus curvula ...	'Maw-worm'—'pinworm' 'thread worm.'	Rectum of the horse.
Oxyrus vermicularis.	Thread worm.	Rectum of man.
Ascaris megalocephala.	Horse worm.	Intestines of the horse.
Ascaris lumbricoides bovis.	Round worm of ox.	Intestines of the ox
Ascaris marginata ...	Round worm of dog.	Intestines of the dog.
Ascaris lumbricoides hominis.	Round worm of man.	Intestines of man.
Filaria lachrymalis equi.	Worm in the eye.	Within the aqueous chamber of the eye of the horse.
Filaria lachrymalis bovis.	Do.	On the surface of the cornea and at the inner canthus of the eye of the ox.
Sub-kingdom Arthropoda (jointed-limbed animals) Class, Arachnoidea (scorpions, spiders, mites). Order, Acaridea (mites).		
Sarcoptes hominis ...	'Itch'	Man.
Sarcoptes equi ...	'Sarcoptic mange.'	Horse.

LIST OF THE PRINCIPAL ANIMAL AND VEGETABLE PARASITES—*cont.*

Scientific name.	Common name.	Attack.
Sarcoptes ovis ..	'Sarcoptic mange.'	Sheep.
Sarcoptes suis ...	'Mange' ...	Pig.
Sarcoptes canis ...	Do. ...	Dog.
Dermatodectes equi ...	Do. ...	Horse.
Dermatodectes bovis.	Do. ...	Ox.
Dermatodectes ovis	'Scab' ...	Sheep.
Ixodes ricinus ...	'Dog tick' ..	Dog, also man, ox and sheep.
Ixodes reduvius ...	'Sheep tick'	Sheep and goats.
Ixodes reticulatus ...	'Ox tick' ...	Ox and also sheep and goats.
Class, Insecta	...	...
Order, Parasita	...	...
Hæmatopinus macrocephalus.	'Horse-louse.'	Horse.
Hæmatopinus eurysternus.	'Sucking ox louse.'	Cattle.
Hæmatopinus eurysternus ani et vulvæ.	'Sucking cow louse.'	Cow (genital parts).
Hæmatopinus vituli...	'Sucking calf louse.'	Calves.
Hæmatopinus stenopis.	'Sucking goat louse.'	Goats.
Trichodectes scalaris.	'Biting ox louse.'	Cattle.
Melophagus ovinus .	'Ked'— 'Sheep louse.'	Sheep.
Order, Diptera	'Bot'	Horse (stomach).
Oestrus equi	'Ox-bot'—	Ox (under the skin).
Oestrus bovis ...	'Warble.'	

LIST OF THE PRINCIPAL ANIMAL AND VEGETABLE PARASITES—*cont.*

Scientific name.	Common name.	Attack.
Oestrus ovis	'Sheep bot' ...	Sheep (nostrils).
Tabanus bovinus ...	'Ox gadfly' ...	Cattle (sucks blood).
Tabanus autumnalis.	'Horse gadfly.'	Horse (sucks blood).
Musca vomitoria ...	'Maggot flies,' 'blow flies,' 'blue, bottle flies,' 'Maggots in wounds.'	Wounds and ulcers in cattle, sheep and goats.
Musca cadaverina.		
Musca cæsar, etc.		

Vegetable Parasites.

Order, Fungi.		
Achorion schouleinii.	'Tinea favosa.;' honey-comb ring worm.	Skin of ox.
Trichophyton tonsurans bovis.	'Tinea tonsurans;' common ring worm.	Do.
Trichophyton tonsurans equi.	...	Skin of horse.

Milk Yields of Cows.

Yield of milk.	Nellore (1).		Aden Banu (2).		Kerry (3).		Cross-bred Bhagiam I (4).		Nellore Raja (5).
	M. MS.	LB.	M. MS.	LB.	M. MS.	LB.	M. MS.	LB.	L.B.
First month ...	110	443	77	311	128	515	18	73	465
Second ,, ...	114	459	85	340	159	636	97	391	511
Third ,, ...	106	425	91	365	155	620	107	429	518
Fourth ,, ...	111	445	91	366	138	552	117	470	404
Fifth ,, ...	112	450	94	378	134	536	117	471	161
Sixth ,, ...	115	462	99	399	135	540	121	484	294
Seventh ,, ...	116	464	97	390	136	546	120	481	316
Eighth ,, ...	102	411	97	391	126	506	89	358	283
Ninth ,, ...	70	283	87	348	128	515	86	346	291
Tenth ,, ...	56	226	89	356	114	458	65	261	309
Eleventh ,, ...	40	161	79	319	105	420	38	155	311
Twelfth ,, ...	27	110	54	217	99	396	24	96	283
Thirteenth ,, ...	...	...	61	247	85	340	...	...	271
Fourteenth ,, ...	...	...	55	222	88	354	...	...	269
Fifteenth ,, ...	...	...	...	...	78	315	...	...	256
Extra parts of month ...	...	...	18	72	62	248	3	12	22
Total ...	1,086	4,344	1,181	4,727	1,874	7,498	1,007	4,030	4,964

Note.—The first three records are of cows kept at Saidapet: the fourth was a cross-bred Ongole-Kerry-Aden cow at Coimbatore and the fifth a Nellore cow, also at Coimbatore.

ANALYSES.

Cows' Milk.

	Per cent.		
	From	To	Average.
Water	87·5	84·5	86·0
Fat	3·5	6·0	4·5
Proteid	3·1	3·4	3·3
Sugar	4·1	5·1	4·8
Ash	·6	·8	·7

Buffalos' Milk.

Water	80·0	85·0	82·4
Fat	5·0	10·0	8·1
Proteid	4·3	4·5	4·3
Sugar	4·2	5·0	4·5
Ash	·7	·8	·7

Goats' Milk.

Water	85·5
Fat	4 0
Other solids	10·5

Cream.

Fat	47·6	68·0	57·0

Skim Milk.

Water	90·2
Fat	1·0
Proteid	4·0
Sugar	4·0
Ash	·8

Butter Milk.

	Per cent.		
	From	To	Average
Water	...	...	90·5
Fat	...	...	·2
Proteid	...	...	3·3
Sugar	...	...	5·3
Ash	...	...	·7

Butter.

Water	12·5	17·0	14·5
Fat	81·0	85·0	84·5
Proteid	·2	·3	·2

Whey.

Water	...	...	92·2
Fat	...	...	·3
Other solids	...	...	7·5

Colostrum (Cows').

Water	...	...	75·0
Fat	...	...	6·0
Other solids	...	...	19·0

Useful Data.

One gallon of milk weighs 10 lb.
One bottle of milk weighs roughly 1 lb. 4 oz.
One Madras Measure of milk weighs 4 lb.
One seer of milk weighs 2 lb.

An ollock of milk is 12½ cubic inches, and contains about 8 ounces of milk. Cows are occasionally sold when in milk on the valuation of Rs. 10 for every bottle of milk given per day; i.e., a four-bottle cow will be sold at Rs. 40.

The specific gravity of milk is from 1,028—1,032 (water 1,000); that of skimmed milk 1,034—1,037, of cream 985. In testing milk for quality by a specific gravity method, one should be sure that the milk is not adulterated, because the

removal of fat which will increase the specific gravity, may be counterbalanced by the addition of water which will reduce it.

Buffalos' milk is much richer than cows' milk and may contain as much as 10 per cent of butter fat. In estimating the amount of butter to be got from any milk, it will be found approximately equal to the percentage of fat as found by analysis, the loss of fat which occurs in making the butter, being made up by the water contained in the butter. The following table is calculated on this assumption :—

Percentage of butter fat.	Pounds of milk to make one pound butter.	Pounds of milk to make one pound ghee.
10·00	10	15·0
9·09	11	16·5
8·33	12	18·0
7·69	13	19·5
7·14	14	21·0
6·66	15	22·5
6·25	16	24·0
5·88	17	25·5
5·55	18	27·0
5·26	19	28·5
5·00	20	30·0
4·76	21	31·5
4·54	22	33·0
4·35	23	34·5
4·17	24	36·0
4·00	25	37·5

The ghee is taken as 70 per cent of the butter : this is only approximate ; from 70—80 per cent may be obtained.

The percentage of cream obtained from milk will vary according to the quality of the milk and the setting of the Separator. Thus 6—8 lb. of buffalos' milk will give 1 lb. of cream (14 per cent), or 10—12 lb. of cows' milk (9 per cent).

One Madras measure of buffalos' milk should give 10 – 12 oz. cream and 4 – 5 oz. of butter.

One viss of ghee (3⅛ lb.) is obtained from 60—70 lb. of buffalos' milk.

100 lb. of cream will yield 30 lb. butter and 70 lb. butter milk. 100 lb. of skim milk will yield 75 lb. curd and 25 lb. whey.

EQUIPMENT OF THE DAIRY (FOR 100 COWS).

	Rs.
Separator	200
Churn	85
Delaiteuse (centrifugal drier) ...	75
Dairy herd recorder	40
Milk filter (Hygeia)	20
Scoops (2)	5
Scotch hands (2)	5
Butter prints (5)	5
Measures (3)	5
Large receiving drums (2)	30
Buckets (5)	35
Hair sieve (2)	3
Scales	20
Furniture	15
Soap, towels, brooms, stationery, baskets, ropes, matches, etc.	30
Total ...	573

For calculating the yield of milk from a herd, the following figures from the herd at Coimbatore may be of use :—

In November 1913, 22 cows in milk gave 124 lb. of milk, i.e., about 5·6 lb. of milk per cow in milk. In addition to these there were 19 cows dry, so that the average yield for the 41 cows is only 3 lb. In March 1914, 22 cows in milk gave 163 lb. daily or an average of 7·4 lb. Adding 18 dry cows, the average for the whole herd of 40 cows was 4·1 lb. The proportion of dry to milking cows is from 39 to 46 per cent.

COMMON INSECT PESTS.

PADDY.

(i) The Stem-borer Moth (*Schœnobius bipunctifer*) is a serious pest in all rice-growing areas, destroying probably an eighth of the total crop in normal years and one quarter or more in bad years. The caterpillar feeds in the stem, and remedial measures consist chiefly in ploughing the stubble and burning or burying it as soon as the crop has been harvested.

(ii) Rice Hispa (*Hispa aenescens*), a small blackish spiny beetle, which damages young plants, occurring on the West Coast especially. No remedy can be advised until its life history and manner of occurrence have been studied.

(iii) Rice Bug (*Leptocorisa*), a narrow greenish insect which sucks the ripening grain, causing very marked diminution of yield when it is abundant, especially on the West Coast and in South Kanara. Remedy—"bagging",i.e , catching the bugs in nets dragged over the crop, or in small hand nets.

(iv) Caterpillars (*Spodoptera mauritia* and *Syrphis*) occur in occasional outbreaks with heavy damage. Isolation of attacked areas by trenching around them, bagging and ploughing are remedies indicated

(v) Rice Case Worm (*Nymphula depunctalis*) is a caterpillar which lives in the water itself, in a small case made of bits of grass, etc. It occurs chiefly in Malabar where it does serious damage. It is checked to some extent by small fish. Draining the water off the fields, when possible, is a simple remedy.

(vi) Rice Grasshopper (*Hieroglyphus*), a greenish grasshopper which occurs chiefly in Malabar and South Kanara. Can be checked by bagging the young hoppers.

SORGHUM.

(i) Moth-borers (*Chilo simplex* and *Sesamia*), whose caterpillars bore into the stem of the plant, occur in all areas and form the chief pest of Sorghum. They attack young and old plants, in the latter, often leading to serious and widespread reduction of crop. Remedies indicated are (*a*) removal and immediate destruction of all plants seen to be withering; (*b*) disposal of the stubble and dry stalks during the winter season.

(ii) Cholam Bug (*Calocoris angustatus*) occurs chiefly in the Gōdāvari and Kistna districts. The ripening grain is sucked out and is either not formed or is light.

Remedy—?

(iii) Mites, causing rust of the leaves.

(iv) Deccan Grasshopper (*Colemania sphenarioides*), a greenish wingless grasshopper which has only recently begun

to attack cultivated crops. It attacks the crop in all stages, devouring the leaves and even the grain.

Remedies.--(*a*) Bagging the young hoppers from July to November ; (*b*) ploughing, where practicable, to destroy the eggs which are in the ground from January to June.

Pennisetum Typhoideum.

(i) Hairy Caterpillars (*Creatonotus spp.*) attack the crop regularly in South Arcot. Attracting the moths to lights at night has been tried but further investigation is required. The white moths should be collected and destroyed.

(ii) Green Bug (*Nezara viridula*) is a pest in Tinnevelly, Guntūr, etc., attacking the ripening crop. Can probably be collected by hand and destroyed.

(iii) Grasshoppers of several kinds attack this crop also ; bagging is usually effective for these.

Eleusine coracana.

Grasshoppers of several kinds. Remedy, bagging.

Millets.

(i) Surface Grasshoppers eat young plants and grain heads ; they may be caught by bagging in nets.

(ii) Stem Fly attacks young plants. Destruction of plants seen to be attacked is probably the only remedy.

Maize.

The principal pest is Stem-borer (Chilo), the caterpillar of which bores in the stem. Destruction of withering plants and disposal of stubble are remedies indicated.

Wheat.

A very small green-fly (*Aphis*) does considerable damage at times.

Sugarcane.

(i) Stem-borers of various kinds are important pests especially in the young crop. All dead hearts should be rigidly cut out and burnt.

(ii) Mealy-wing Bugs (*Aleurodes*) are important chiefly in ratoon crops ; they suck the leaves, leading to weak plants and very inferior juice, making bad sugar.

(iii) White-ants (*Termes spp.*) often do great damage to young sets. Soaking these in a solution of copper sulphate before planting and the use of insecticides in irrigation water will usually check the attack until the young canes are established.

Pulses.

There are various minor pests, but very little is known as yet regarding the insects which attack this class of crop.

Gingelly.

Is attacked by a caterpillar (*Antigastra*); hand-picking is probably the best remedy.

Castor.

Attacked by semi-looper caterpillars (*Achoea*) and by Hairy Caterpillars. Hand-picking is probably the best remedy. In bad cases, cutting down the plants may be necessary.

Groundnut.

(i) Surul (*Anacampsis nerteria*) is the most important pest. May perhaps be checked by light-traps, but further investigation is required.

(ii) Verpuchi (*Sphenoptera*) is a pest of general occurrence, causing considerable loss by boring in the stem. All plants attacked should be removed from the field and destroyed.

(iii) Hairy Caterpillars occur especially in South Arcot.

Cotton.

(i) Bollworm (*Earias*) attacks firstly the top shoots of the young plants and afterwards bores into the bolls. All top-shoots seen to wither should be removed and destroyed and the same practice applied later on to all bolls found to be attacked. The removal of the plants from the fields immediately after harvest will of itself form a remedy also.

(ii) Red Cotton Bug (*Dysdercus*) sucks the bolls, destroying the seed and staining the lint. May easily be collected by hand and destroyed.

(iii) Dusky Cotton Bug (*Oxycarœnus*) is a very small bug which breeds chiefly in old bolls, which have been attacked by the Bollworm. All these old useless bolls should be removed and destroyed.

Brinjal, Gourds and Melons, Sweet Potato.

These are all attacked by various minor insect pests. The usual remedy is the complete destruction of the plants or fruits affected.

Tobacco.

(i) Tobacco Caterpillar (*Prodenia*) does damage especially in the nurseries; may be picked off by hand; in bad cases it may be necessary to irrigate or trench.

(ii) Stem Caterpillar (*Pthorimœa*) bores in the stem causing characteristic swellings. Young plants attacked should be destroyed and replaced.

Agaththi.

(i) Is bored by *Azygophleps* ; borer should be cut out.
(ii) Weevil (*Alcides*) may be collected by hand.
(iii) Tobacco Caterpillar (*Prodenia*) may be hand-picked ; in bad cases ground may be irrigated or trenched.

Mango.

(i) The Mango Beetle (*Batocera*) bores the branches as a large white grub. It should be cut out and the wound tarred over.
(ii) The Mango Hopper (*Idiocerus*) is often a serious pest and can only be controlled by spraying early in the season.
(iii) Fruit fly (*Dacus*) attacks the fruit itself. All attacked and fallen fruit should be destroyed.
(iv) The Mango Weevil lives inside the stone of the fruit.

Pomegranate.

The caterpillar of a small Blue Butterfly (*Virachola*) bores into the fruits. Attacked fruits should be destroyed.

Grapes.

(i) Cockchafers often do damage. They are probably best dealt with by spraying a sweetened arsenical poison on to the leaves.
(ii) Scales (*Aspidiotus*) can only be treated by spraying with a contact poison such as rosin wash.

Palms.

Both Coconut and Toddy palms are attacked by the Rhinoceros Beetle (*Oryctes*) and the Red Weevil (*Rhynchophorus*). The former bores into the crown and the latter then lays its eggs in the hole made by the former. The grubs of the Weevil bore into the tree and ultimately kill it after which the grubs of the Rhinoceros Beetle live in the decaying stem. Old dead stumps should be cut down and burnt and accumulations of leaves, etc., under the trees should be avoided, as the large white grubs of the Rhinoceros Beetle will breed in any heaps of decaying vegetable rubbish.

Bordeaux Mixture.

Bordeaux mixture is a preparation of copper sulphate and quicklime in water. It may be used strong or weak. The strength generally regarded as a standard is :—

Copper sulphate	...	...	5 lb.
Quicklime	...	...	5 lb.
Water	...	...	50 gallons.

A mixture of this strength is known as the 5–5–50 formula.

The quantity to be made at one time is a matter of convenience, depending on the number of plants to be sprayed and on the available vessels.

Fifty gallons is often a convenient quantity to make at a time ; for this, one 50-gallon barrel and two 25-gallon tubs are required. The method of preparation is always the same whatever the quantity of mixture required—

(1) Wrap 5 lb. of copper sulphate in a piece of gunny bag, powder it on a stone, tie up the piece of gunny and suspend it by a string to a stick laid across the mouth of a tub containing 25 gallons of water. In a short time the copper sulphate will have dissolved.

(2) Put 5 lb. of good quicklime in a tub, and sprinkle about a quarter of a gallon of water on it. When the lime begins to crack and crumble add more water a little at a time, taking care that the lime does not become too dry. Keep on adding water, a little at a time, till a thick creamy paste free from lumps is formed. Add the requisite quantity of water to make up to 25 gallons. Stir well.

(3) While stirring vigorously, slowly pour the solution of copper sulphate and the milk of lime together into the large barrel. Keep stirring for two or three minutes.

Properly prepared mixture is of a light sky blue colour.

When using Bordeaux mixture during the monsoon, an adhesive substance must be added to prevent the mixture being washed off by the rain. An efficient adhesive may be prepared from resin and washing soda. For the above quantity of 50 gallons Bordeaux mixture put 2 lb. washing soda in an earthenware pot containing 2 gallons of water and bring to the boil. Add 4 lb. of powdered resin, a little at a time. For the first half hour the liquid is liable to boil over, so the fire should be a slow one, as the liquid becomes clear the fire may be made to burn more brightly. The liquid should be boiled altogether an hour. It becomes clear like coffee decoction. While stirring vigorously slowly add the resin-soda liquid to the Bordeaux mixture.

Test.—Rub the blade of a knife in sand or earth till it is polished, then dip in the mixture for a minute. If the blade is unchanged the mixture is safe. But if the blade becomes red, then more lime must be added, till the clean blade is not stained when dipped afresh in the mixture.

HORTICULTURE.

	Number of trees per acre.
2 feet each way	10,890
3 „ „	4,840
4 „ „	2,722
5 „ „	1,742
6 „ „	1,210
8 „ „	680
10 „ „	435
12 „ „	302
15 „ „	200
18 „ „	135
20 „ „	110
25 „ „	70
30 „ „	50
35 „ „	35
40 „ „	27

Hedge Plants.

Hedges are used for guarding against trespass, providing lateral shade and for ornament. Almost any plant can be used for one or other of these purposes, but attention here is chiefly directed to such hedges as are agriculturally useful. For gardens there are a very great number of hedge plants in India and all stages can be obtained between creepers on trellises on the one hand and rows of all shrubs and borders for ornamental beds.

1. *Pithecolobium dulce*—
   Korukapili—Tamil.
   Simachintha—Telugu.

This is a leguminous plant well suited for hedges as it stands any amount of cutting back. Seeds must be sown in 2 or 3 rows. When the plants are about 2 feet high, they must be topped to make them branch, and during each year they must be cut back at least twice. Gaps in old hedges may be filled up by half cutting through tall branches and laying them down across the gaps.

2. *Opuntia Dillenii*—The prickly-pear.
   Sappaththi Mullu—Tamil.
   Nagadali—Telugu.

An excellent hedge, impenetrable and easily made, with one disadvantage that it takes up rather a lot of room. It leaves the land on which it grows enriched, however, and crops can

be grown right up close to it. It is propagated by simply laying cut pieces on the ground.

3. *Balsamodendron Berryi* *—
Mullukiluvai—Tamil.

It is possible to get a good hedge by planting cut branches just before the commencement of rains (June or July). To keep the hedge in good condition it must be cut back occasionally.

4. *Euphorbia Tirucalli*—The milk hedge.
Tirugukalli—Tamil.

A small tree with round stem and smooth cylindrical branches. Useful as a hedge plant because cattle will not approach it as the milky juice or latex is acrid and irritating. It causes acute pain if it gets into the eyes. Easily propagated by cuttings.

5. *Euphorbia Antiquorum*—
Chadurakkalli—Tamil.

This is also often used as a hedge plant and is raised from cuttings.

6. *Casuarina equisetifolia*—
Savukkumaram—Tamil.
Chavukku Manu—Telugu.

These plants form a very handsome hedge as may be seen on the Marina, Madras Beach, if constantly pruned and trimmed. Casuarina must be raised from seeds.

7. *Arundo donax*—very often forms a thick impenetrable hedge, generally seen round betel gardens. It is planted from stumps.

8. *Saccharum arundinaceum*—
Pekkarumbu—Tamil.
Verricheruku—Telugu.

This is also a common hedge plant round betel gardens. Propagated from stumps.

9. *Sesbania grandiflora*—
Agaththi—Tamil.
Avisi—Telugu.

10. *Sesbania egyptiaca*—
Siththagaththi or karunsembai—Tamil.

These plants are sometimes used in betel gardens to form a hedge. Both are raised from seeds.

11. *Poinciana etata.*—By planting stumps a good hedge may be formed. But the shoots must be constantly trimmed or it will become thin below.

12. *Lawsonia alba*—Henna.
Maruthani - Tamil.
Gorantaku Telugu.

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* See page 40.

By sowing seeds or by planting cuttings a hedge may be formed. As with others this must be constantly cut back.

13. *Acacia farnesiana*—
Pee Velan—Tamil.
Kamputumma—Telugu.
and

14. *Acacia arabica—Babul.*
Karuvelan - Tamil.
Nallatumma—Telugu.

Both these Acacias are capable of being used for hedges. They must be raised by sowing seeds and cut back at intervals.

15. *Agave americana and other agaves.*
Kaththalai—Tamil.

Agave plants may be propagated from suckers. These plants form a fine hedge after some time. Little or no attention is required after planting.

16. *Borassus flabellifer*—The Palmyra palm.
Panai—Tamil.
Thadi—Telugu.

The Palmyra palm can be propagated only by seeds. By sowing the seeds in rows these may be made to grow so as to form a hedge. As they grow very slowly, they form a good hedge for a considerable period of time.

Coconut Gardens.

East Coast.

Thoroughly ripe nuts from trees that have passed the middle age are carefully collected and dried in the shade for about a fortnight. These nuts are then arranged one touching the other in a seed-bed with the butt-ends above, covered with sand, and irrigated every day. The nuts begin to germinate after about two months, all finish sprouting after 5 or 6 months. When the seedlings are about 3 feet high or 6 to 8 months old, they are lifted and permanently transplanted in all the southern districts. In the northern districts these are transplanted 7 feet apart in a second seed-bed, and 3 or 4 years after, these are again lifted and transplanted permanently in a field at the rate of 50 or 60 per acre. In the south as many as 150 per acre are planted. The trees begin to bear 8 to 10 years from the date of planting tho nuts, but the full bearing is to be expected after 12 years. On an average about 50 or 60 nuts can be expected from each tree, and the trees bear for about 100 years provided proper care is taken. In the south, tapping coconut trees is very common, but in the north it is entirely absent.

Root pruning and careful manuring are the secrets of successful coconut cultivation. In the southern districts, coconut topes are irrigated, but in the north a surface mulch of fine soil is provided by ploughing immediately after the rains.

West Coast.

Ripe nuts are carefully gathered from the middle-aged trees in February-March, germinated and planted out after six months to three years, in February-March or June-July, according as the land is low or high lying. Sixty trees per acre is a fair number, but even double the number is not uncommon in certain parts.

Sandy loams are the best. Along sea-coast and river banks they flourish very well. The yield per tree varies from 10 to 100 nuts. The trees may live long, 75 years or more; generally begin to bear fruit in about 12 years increasing in yield up to 60. It has been observed along salt water river banks that the trees begin to bear in about 5 years, but die an earlier death.

They require plenty of sun and water, and respond to heavy manuring. They are opened out in June-July and manured with green leaves and ashes. This operation facilitates percolation of water and formation and development of young roots.

There is nothing else in the West Coast to be compared to this tree in point of yield and usefulness, every bit of it being of great economical value. It is therefore rightly called "Kalpaka Vriksha," i.e., the tree that gives all the requirements of man.

ARECA NUTS.

Ripe nuts are gathered from old trees and seedlings are raised from them. When about six months old, they are transplanted, generally in June-July. Loamy soils at the bottom of a valley, cool and moist, are the best fitted. They grow straight and tall. begin to bear in about 10 years and may live over 80 years, the yield becoming less and less after middle age. They give three to six bunches, varying from 50 to 200 nuts each, even more in favourable localities if properly watered and heavily manured. A rupee per tree is not an exaggerated figure. The nuts are prepared and largely exported from the West Coast. They are used for chewing with chunam and betel leaves, with or without tobacco. They are valuable as a medicine. The stem is much used for house construction.

Mango Gardens.

The number of plants to the acre varies with the soil. On rich soils where the trees spread well, 20 to 25 are planted, while on gravelly soils where the growth is rather stunted, up to 50 trees to the acre. The best distance is 40 feet apart, in rows 30 feet apart, the plants arranged quincuncially, whereby 36 go to the acre. Grafts are not allowed to bear for the first three or four years to promote growth. Afterwards an average yield of about Rs. 2 to 3 may be expected from each tree. The value of the fruit varies considerably with the variety. There are varieties that fetch up to Rs. 4 a dozen. The gardens can be considerably improved by interculturing and growing a pulse crop like horsegram. Graft mango gardens bear well for about 50 years when they must be renewed.

Jack Gardens.

The Jack is a tree, which requires plenty of rainfall, and moist and dewy climate : it is rare in parts of the East Coast where the conditions are adverse, but is quite a common tree in the West Coast bearing very heavily in the dewy, cold and mountainous interior villages.

It is always planted mixed with coconut, arecanut, mango and pepper, serving as a standard for the last-mentioned creeper. Its top shade is very heavy and highly objectionable to the neighbouring trees. When alone, 20 trees will be ample per acre. Seedlings are raised from well chosen nuts from young trees, and they (4 to 6 months old) are planted out in well prepared and protected pits at the close of the South-West Monsoon rains. They should be watered when necessary.

Red loams with an admixture of gravel are preferred. The trees grow slowly, begin to bear in about 12 years, live long, even over 100 years : flower in December-January ; harvest is completed in June-July. They are seldom manured, but the garden receives one or two diggings a year. The yield per tree varies considerably from 5 to 200 fruits (worth 5 annas to 5 rupees) with age, soil and locality. It is a poor man's food on the West Coast. There are two main varieties, hard and soft, known as Varikai and Pazhom. The wood is one of the best in the world in point of hardness and polish, with golden yellow colour. It is excellent for all kinds of woodwork, particularly for furniture.

Plantain Gardens.

[This note refers to the practice which prevails in the Cauvery valley.]

The land is leased for three years: pits are dug about 7½ feet apart, and in the month of October, 750 suckers to the acre are planted. Drains are dug between every alternate row in both directions, dividing the land up to into a number of beds. After one month, the field is dug over thoroughly some six times, i.e., every alternate month. Fencing has to be attended to, and manure—generally a mixture of cattle manure and tannery refuse—is applied four months after planting. The trenches are deepened, and irrigation attended to, and the removal of side suckers from May onward, and the earthing up of the trees is carried out.

Bunches appear in October and November, twelve to thirteen months after planting, and are collected until February. Meanwhile, only one new sucker has been left and the land is dug over, but only twice during the second year, in February and June: manure is given after the first digging. The second crop is obtained from October to February. Towards the end, suckers are not removed, the object now aimed at being to get plenty of leaves which are eventually cut and sold in June, when the whole crop is removed. A crop of paddy is taken before the land is handed back to the lessor.

Casuarina Topes.

Usually poor sandy soils of upland tracts are put under casuarina cultivation. Ripe fruits from old trees are gathered in the hot weather, put in earthen pots and kept in the sun. The fruits burst and the seeds are then carefully dried and stored. Twelve ounces of seed sown on 100 square feet will supply seedlings sufficient to transplant one acre. The seed is sprinkled evenly on the surface of the nursery and covered thinly with ashes and cattle manure. The plot is then covered with straw, leaves, etc., and regularly watered. The seeds sprout in 8 to 10 days. Care should be taken to keep weeds and ants from the nursery. After three months, the seedlings should be transplanted in another nursery and they are finally removed for planting in the field in 6 or 8 months, i.e., when they are less than 3 feet high. 3,000 to 4,000 small pits are dug with mamuty in an acre 3′ to 4½′ apart, kept exposed for a time, and then hand-watered just before planting. The pits are not manured,

The plants should be watered almost daily till they take root, and then they can be watered once a week during the first year, or in exceptional cases, for two hot weather seasons. The plantation should be thinned and all crooked plants removed, leaving 1,500 plants to the acre. The trees will be ready for cutting in 10 years, and will fetch about Rs. 750 to 1,000 per acre at 8 annas per tree. In the intervening years the proceeds from the loppings of the side branches, etc., will defray all expenses such as hand-watering, etc. After the plantation is cut, about 50 per cent of the roots will put forth fresh shoots, and when the dead roots are dug out, a groundnut crop may be raised in the interspace. The ratoon plantation will also be ready for cutting in 10 years.

Batavian Orange Gardens (Circars).

Seeds are collected from ripe fruit of fairly aged trees, mixed with ashes and dried in the shade for about a week. These are then planted in a seed-bed about an inch apart. When the seedlings are about 6 inches high, they are lifted and transplanted in a second nursery about 6 inches apart. Here they are kept for 3 years or even more. Seedlings about 3 years old are available at Rs. 50 per 100. These are transplanted 15 to 16 feet apart, or 150 or 200 plants to the acre depending on the nature of the soil. Plantains are also planted to give shade to the young transplants. The trees begin to bear seven years after permanent transplanting. A mixture of red earth and sheep manure is considered to be a very good manure. On the borders of the gardens, limes, pumelos, citrons are always planted. Along the water channels very good pineapples are also grown. On an average each tree gives about 200 fruits worth about Rs. 5, in the garden itself. The garden gives full produce for about 20 years.

Babul Topes.

Land intended for babul topes may be either sown, or trees may be allowed to spring up naturally from seed passed by sheep or goats which have browsed over the land. The seed possesses a hard coat which unless scratched or pounded in some way may interfere with germination. No further treatment of the land is necessary, and the plantation may be left to itself. The rate of growth depends upon the soil and the tope may be mature in anything from 10 to 20 years, i.e., be of a size sufficient to afford marketable timber. The grazing under babul is generally good, and the pods themselves are a valuable and nutritious food.

Bamboo Topes.

(This note embodies the practice at Ayyampet, Tanjore District.)

The seeds are sown in the nursery in July-August. One Madras measure of seed, which costs from Re. 1 to Rs 5, is sown in one cent divided into 25 beds. Seeds keep their vitality only for one year. Seeds germinate in six or seven days. Until then the nursery is shaded. Beds are watered once a day for a week and are kept free from weeds. About four months after sowing, i.e., in December-January, the seedlings are removed and planted in bunches of four plants at 8 inches apart. *Agathi grandiflora* or *Sesbania aculeata* is sown here and there for shade. In this condition the seedlings remain for about two years. Afterwards they are removed and planted in *padugai* lands (in pits) in bunches containing from four to ten tillers at 8 feet apart. While planting the plants are topped from 4 feet to 2½ feet high. Seedlings in 100 kulis or 33 cents are sold for Rs. 200. These are sufficient for planting 4¼ acres. There is a class of Muhammadans (Ravuttars) who grow seedlings for sale and have made this their business. No manure is applied to bamboos and no other particular operation is given except pruning from the third or fourth year. The cost of pruning will be realized by the sale of loppings, besides getting the area fenced round. The bamboos will be fit for cutting from about the fifth year after the final planting or about seven and a half years from the date of sowing the seed. In some places they are cut when they are about ten years old. The cutting is done in alternate years and the value of the yield amounts to Rs. 400 or 500 every other year or from Rs. 200 to 250 per acre annually. The bamboos are sorted into four classes according to different sizes :—

I	Class	...	...	Rs. 40	per 100.
II	,,	...	...	,, 30	,,
III	,,	...	...	,, 20	,,
IV	,,	...	...	,, 10	,,
Mother branches			...	,, 2	,,

It is said that bamboos flower once in sixty years, when they all die. Some say that they flower in thirty years.

Pruning.

The proper pruning of trees is often much neglected and the loss in timber, foliage and fruit thereby caused is very considerable. The matter receives very careful attention among horticulturists in temperate climates, but it is

rendered difficult in India because of the rapid growth, and the absence of any true resting period, when pruning usually takes place. Stated briefly, the object of pruning a tree is to give it a good natural shape, whereby all its branches, leaves and flowers have free space to grow, and incidentally, to increase the number of these. An ideal form must be aimed at in each tree, but, as the natural habit of trees varies very much, this will differ with the species. Compare for instance the cork tree (*Millingtonia suberosa*) of erect, narrow habit and the low flat-crowned gold mohur with the well rounded tamarind. All three of these must be treated in entirely different ways, to obtain the maximum of leaf surface. Seeing that trees are so constantly cut for fuel, fodder and leaf-manure in South India, a recognition of the general principles of pruning is very important.

Pruning for fruit is little understood in India. Two of the commonest methods adopted for increasing fruitfulness are root-pruning and shoot-pruning, and one example has been chosen among Indian fruit trees to show that the right method can only be arrived at after a careful study of the natural habit of the plant. The guava is a small tree or large shrub of very variable shape, but the flowers and fruits are borne in very well defined places. A little study will show that, when a new shoot appears, the second, third and fourth pairs of leaves usually bear flowers in their axils, and that these are produced nowhere else. If then a tree has become unfruitful numerous new shoots must be produced. Some grafted Chinese guavas in the Botanic garden at Coimbatore, had not borne fruit after three years' growth, and two of them were taken for experiment. In the first, a deep trench was dug around and all the roots were cut across; a severe pruning of all its branches was given to the second. The result was very instructive. The root-pruned plant dropped many of its leaves but produced no new shoots and therefore no flowers. The shoot-pruned plant was covered with bursting buds within a week of the operation. Many of these bore flowers in the usual place and, after six months, there were nearly a hundred fruits upon it.

SOME COMMON TIMBER TREES.

1. Grewia tiliæfolia, Vahl.

Vernacular.—Sadachi. Thadasu, Unu, Tam.* ; Thadasu, Mal. ; Thadasal, Kan. ; Thana, Thadda, Tel. ; Dhomono, Oriya.

Habitat.—Throughout the Presidency, ascending to 4,000 feet.

Description.—A moderate sized deciduous tree. Wood brown, hard, tough, and elastic. Takes a good polish. Weight about 40 lb.*

Chief uses.—Boats, masts, oars, ploughs, shoulderpoles, tool-handles, house posts, door and window frames, furniture, carts (all parts), excellent for cooper's work. Has some of the properties of American hickory.

By-products.—Fibre extracted from the bark.

2. Azadirachta indica, Juss. (Melia indica, Brandis.)

The Margosa or Nim.

Vernacular.—Veppam, Vembu, Tam. ; Veppu, Mal ; Betta Bevan, Kan. ; Yepa, Veppa, Tel. ; Limbo, Oriya.

Habitat.—Natural in the dry forests of the Carnatic and Deccan but widely planted especially as an avenue tree.

Description.—A moderate to large sized deciduous tree. Heartwood red, hard, close-grained, scented, resembling mahogany, durable. Weight about 50 lb.

Chief uses.—House building (all parts except planking), furniture, carts, axles, yokes, naves and felloes, ship and boat building, oars, ploughs, oil-mills.

By-products.—Bark yields a febrifuge, seeds expressed for oil, all parts medicinal.

3. Cedrela toona, Roxb.

The Red cedar.

Vernacular.—Santhana-Vembu, Agli, Tam ; Vembu Vella-Agil, Mal. ; Noga, Kan. ; Mahalimbo, Oriya.

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* *Note.*—The weights of wood given are per cubic foot, dry. The abbreviations of Vernacular names used are as follows :—

Tam.	...	...	...	= Tamil.
Mal.	...	...	...	= Malayalam.
Kan.	...	...	...	= Kanarese.
Tel.	...	...	...	= Telugu.

Habitat—Western Ghats and low hills of Southern India.

Description.—A large deciduous tree, wood brick red and soft but even-grained, fragrant and easily worked, seasons readily, does not split or warp when seasoned. Durable and not attacked by white ants. Weight 30 to 35 lb.

Chief uses.—House building (chiefly planking and panels), excellent for furniture and boxes, well-construction, dug-outs, and canoes, oars, yokes, carving.

4. Chloroxylon swietenia, DC.

The Satin wood.

Vernacular.—Karum-porasu, Tam.; Huragalu, Kan.; Billudu, Tel.; Bheru, Oriya.

Habitat.—Dry forests and low hills of Southern India, not in areas of heavy rainfall.

Description. A moderate sized deciduous tree. Wood light-yellow, hard, close-grained, with a satiny lustre. Very durable. Weight 60 lb.

Chief uses.—Much exported to Europe for furniture and cabinet work. Bridge work, wharf-piles, ploughs, agricultural implements, oil-mills, pestles, carving and turning, carts (all parts), boats, tool handles, gunstocks, high class panelling.

5. Mangifera indica, Linn.

The Mango.

Vernacular.—Ma-maram, Tam.; Mava, Mal.; Mava, Kan.; Mamidi, Tel.; Ambo, Oriya.

Habitat.—Indigenous along the Western Ghats, but extensively cultivated everywhere.

Description A large evergreen tree. Wood grey, in old trees sometimes dark-brown, soft. Weight 42 lb.

Chief uses.—Planking, door and window frames, packing cases, tea boxes, cheap furniture, dug outs, well-construction, ploughs, yokes, felloes, cooper's work.

6. Dalbergia latifolia, Roxb.

The Black-wood or Rose-wood.

Vernacular.—Iti, Tam.; Iti, Mal.; Biti, Kan.; Jittegi, Tel.; Siasua, Oriya.

Habitat.—Throughout the Madras Presidency up to 4,000 feet.

Description.—A large deciduous tree. Heartwood dark purple with black streaks, very strong and durable, seasons well without warping or splitting and takes polish well. A very fine timber. Weight about 55 lb.

Chief uses.—High class furniture, carts (all parts), ploughs, well-construction, tool-handles, walking-sticks, cooper's work.

7. Pterocarpus marsupium, Roxb.

The Kino tree.

Vernacular.—Venge, Tam. ; Venge, Mal. ; Honne, Kan. ; Yegi, Yegise, Tel. ; Piasal, Oriya.

Habitat.—Throughout the Madras Presidency except in wet evergreen forests, up to 4,000 feet.

Description.—A large deciduous tree. Heartwood yellowish-brown with darker streaks, very hard, durable, seasons well and takes a fine polish. The heartwood stains yellow when damp. Weight about 55 lb.

Chief uses.—Posts, beams, door and window frames, furniture, agricultural implements, carts (all parts), boat-building, cars, cooper's work.

By-products.—Yields gum kino.

8. Hardwickia binata, Roxb.

Vernacular—Acha, Tam. ; Kamra, Kan. ; Yepi, Tel.

Habitat.—Dry forests of Southern India, up to 3,000 feet.

Description—A large deciduous tree. Heartwood dark-red or purplish, streaked with black, extremely hard, close and cross-grained, very durable, does not warp, but apt to split. Weight about 82 lb.

Chief uses.—House and bridge posts, beams and rafters, carts (all parts), ploughs, clod-crushers, vessels for sowing seeds, hand-looms, well-construction, carving, turning and ornamental work, bearings for machinery, oars.

By-products.—The bark yields a useful fibre.

9. Tamarindus indica, Linn.

The Tamarind.

Vernacular.—Puli, Tam. ; Puli, Mal. ; Hunase, Kan. ; Chinta, Tel. ; Koya, Tentuli, Oriya.

Habitat.—Doubtfully indigenous in India, but everywhere grown.

Description.—A large evergreen tree, sapwood yellowish-white. sometimes with red streaks, heartwood small, present only in old trees, very durable and difficult to work. Weight, sapwood 62 lb., heartwood 80 lb.

Chief uses.—Oil and sugar-mills, rice-pounders, mortars, pestles, ploughs, mallets, tool-handles, furniture, house fittings, well-construction, cooper's work, tent-pegs, side planks of boats, carts, shafts, axles and naves.

10. Xylia dolabriformis, Benth.

Ironwood.

Vernacular.—Irul, Tam.; Irul, Mal.; Jambe, Kan.; Kondatangedu, Tel.; Tangani, Oriya.

Habitat.—Eastern and Western Ghats in semi-moist forests.

Description.—A large deciduous tree, remaining small on poor soils. Heartwood reddish-brown, extremely hard, cross-grained, very durable. Weight 60 lb.

Chief uses.—House building (chiefly posts, beams and scantlings), bridge-construction, piles, telegraph posts, sleepers, railway waggon construction, tent-pegs, railway keys, well-construction, boats, dug-outs, carts (all parts), ploughs, harrow-teeth, yokes, oil-presses, shingles, tool-handles.

11. Acacia arabica, Willd.

The Babul tree.

Vernacular.—Karu-velam, Tam.; Karu-velam, Mal.; Jali Kan.; Nalla-tumma, Tel.; Babulo, Oriya.

Habitat.—Probably not indigenous in Southern India, but abundantly cultivated and self-sown in tank beds, on bunds, along channels and other similar situations where there is alluvial soil and water not far from the surface.

Description.—A moderate sized tree, heartwood pink turning reddish-brown on exposure, mottled with dark streaks, hard, very durable. Weight 54 lb.

Chief uses.—House buildings (posts, beams, rafters, door and window frames), carts (all parts), solid wheels, boat-building, oars, sugar and oil-presses, rice-pounders, ploughs, harrows, clod-crushers, Persian wheels, well curbs, tool-handles, cooper's work, carving and turning, the best wood for tent-pegs. Excellent fuel.

By-products.—Bark yields tannin and a dye, the pods are used as fodder, the resin yields a fair gum.

12. Albizzia Lebbek, Benth.

The Indian Walnut.

Vernacular.—Vage, Sele-unjal, Tam.; Vage, Vel-vage, Mal.; Bengha, Bage, Kan.; Dirisanam, Girisanam, Tel.; Sirisa, Oriya.

Habitat.—Throughout Southern India in the drier parts often planted.

Description.—A large deciduous tree. Heartwood dark-brown streaked with lighter or darker streaks, hard, fairly durable, seasons, works and polishes well. Weight 47 to 50 lb.

Chief uses.—A handsome furniture wood, house building (chiefly posts and beams), ploughs, rollers, oil-mills, sugarcane crushers, yokes, well-curbs, boats, carts (all parts), cooper's work and turnery.

13. Terminalia tomentosa, W. & A.

Vernacular.—Karumarudu, Tam.; Karimaridu, Mal.; Karimadi, Kan.; Nellamaddi, Tel.; Sahajo, Oriya.

Habitat.—Throughout the Presidency up to 4,000 feet but not in evergreen forests.

Description.—A large deciduous tree. Heartwood dark-brown with streaks of dark colour, hard and apt to split in seasoning. Weight 67 lb.

Chief uses.—House building (all parts), rough furniture, oil-mills, rice-pounders, ploughs, harrows, yokes, shafts and axles of carts, boat and ship-building.

By-products.—Bark is used for tanning and dyeing, especially fishing nets.

14. Anogeissus latifolia, Wall.

Vernacular.—Velnage, Vekkali, Tam.; Vella-naga, Mal.; Dinduga, Kan.; Chiruman, Tel.; Dhau, Oriya.

Habitat.—Dry deciduous forests throughout the Presidency up to 5,000 feet.

Description.—A large deciduous tree, often stunted at the higher elevations, sapwood grey, hard, shining, smooth. Heartwood small and irregular, purplish-brown, very hard, very tough, but splits in seasoning. Weight 62 lb.

Chief uses.—Poles and rafters, axles and shafts of carts yokes, naves, ploughs and other agricultural implements, rice-pounders, mortars, tool-handles, tent-pegs, spinning-wheels, shoulder-poles, furniture, boat-building and mine props.

15. Eugenia jambolana, Lam.

The Black Plum.

Vernacular.—Naga Naval, Tam. ; Navil, Mal. ; Nerale, Kan ; Naredu, Tel. ; Jambo, Oriya.

Habitat.—Throughout the Presidency up to 6,000 feet, chiefly along streams, often cultivated.

Description.—A large evergreen tree. Wood reddish-grey, moderately hard, fairly durable, lasts well under water. No distinct heartwood. Weight 48 lb.

Chief uses.—House building (chiefly posts, beams and rafters), carts (all parts), boat-building, oars, masts, agricultural implements, rice-mortars, well curbs, common furniture, carving and turning.

By-products.—The fruit is edible.

16. Adina cordifolia, Hook.

Vernacular.—Manjakadambe, Tam. ; Manjakadamba, Mal. ; Kadamba, Kan. ; Rudrabataganapu, Tel. ; Holondo, Oriya.

Habitat.—Deciduous forests throughout the Presidency up to about 3,000 feet.

Description.—A large deciduous tree, wood yellowish, moderately hard, even-grained, seasons well, but apt to warp and crack. No heartwood. Weight 45 lb.

Chief uses.—Building (posts but chiefly planking), dug-outs, packing cases, light furniture, agricultural implements, yokes, shingles, carving and turning.

17. Tectona grandis, Linn. f.

The Teak tree.

Vernacular.—Tekku, Tam.; Tekku, Mal. ; Tega, Kan. ; Teku, Tel. ; Saguvani, Oriya.

Habitat.—Hilly tracts of Gōdāvari, Kurnool, Cuddapah, Mysore, Coorg, Malabar, the Nilgiris, Coimbatore, Madura, Tinnevelly, Travancore and Cochin.

Description.—A large deciduous tree, wood dark-golden, yellow when fresh, turning dark-brown with age, hard and very durable, rarely attacked by white ants, probably due to the large amount of oil it contains. Does not warp or crack. One of the finest known timbers. Weight 45 lb.

Chief uses.—House building (all parts), bridge-work, ship-building, furniture, ploughs, yokes, harrows, carts (all parts), railway sleepers, railway carriages, casks, well-construction, looms, spinning wheels, etc.

18. Ficus bengalensis, Linn.

The Banyan tree.

Vernacular.—Ala, Tam.; Peria-ala, Mal.; Ala, Goli, Kan.; Marri, Tel.; Bori, Oriya.

Habitat.—Probably not indigenous in the Madras Presidency, but widely planted especially as an avenue tree.

Description.—A large shady tree, throwing down numerous ærial roots from the branches. Wood grey, moderately hard, not durable but lasts well under water. Wood of the ærial roots stronger than that of branches. Weight 36 lb.

Chief uses.—Door panels, boxes, cheap furniture, well curbs, pestles, the wood of the ærial roots is used for tent-poles, cart-yokes, and shafts and shoulder poles.

19. Artocarpus integrifolia, Linn. f.

The Jack tree.

Vernacular.—Pilla, Tam.; Pilavu, Mal.; Alasu, Kan.; Panasa, Tel.; Ponaso, Oriya.

Habitat.—Indigenous in the forests of the Western Ghats up to 4,000 feet, much cultivated elsewhere.

Description.—A large evergreen tree, heartwood bright yellow, darkening on exposure. Moderately hard. Weight 40 lb.

Chief uses.—House building, boats, masts, oars, carts (yokes, naves, spokes and felloes), rice-pounders, cooper's work, well-construction, furniture, boxes and turnery.

By-products.—Yields the well-known jack fruit.

20. Borassus flabellifer, Linn.

The Palmyra Palm or Toddy Palm.

Vernacular.—Pane, Tam.; Pana, Mal.; Pani, Talimara Kan.; Tadi, Tel.; Talo, Oriya.

Habitat.—Not indigenous in India, but cultivated and run wild throughout the Madras Presidency.

Description.—A large erect palm. Wood light-brown and soft inside, outside black and handsomely streaked, hard strong, very durable under water.

Chief uses.—Posts and rafters, water-pipes and gutters, troughs, dug-outs, well-construction, turnery, buckets.

By-products.—The sap is tapped for toddy and jaggery. The leaves are used for thatch, umbrellas, mats, fans, hats, sandals, buckets, basket work, writing tablets, etc. The pulp of the fruit is edible. The fibres are used for brushes.

STATISTICS.

TABLE SHOWING THE AGRICULTURAL POSITION OF THE DISTRICTS OF THE MADRAS PRESIDENCY DURING THE AGRICULTURAL YEAR 1917–18.

District.	Total area.	Area under cultivation.	Area actually cropped.	Average size of holding.	Area cultivated by a pair of cattle.
	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.
Ganjām ...	5,366,900	1,760,218	2,113,652	4·69	5·76
Vizagapatam.	10,999,238	2,348,460	2,807,664	9·94	5·26
Gōdāvari ...	3,980,698	961,453	1,230,709	8·74	4·74
Kistna ...	3,695,343	1,772,786	2,170,425	7·71	8·00
Guntūr ...	3,648,781	2,036,662	2,338,706	7·38	16·30
Nellore ...	5,103,053	1,355,026	1,525,519	7·80	12·52
Kurnool ...	4,833,774	1,998,528	2,062,449	10·13	22·88
Bellary ...	3,649,513	2,336,651	2,365,184	14·68	21·66
Anantapur ...	4,281,825	1,884,862	1,993,734	11·71	15·88
Cuddapah ...	3,757,862	1,050,000	1,156,618	4·99	13·00
Chittoor ...	3,609,292	715,862	843,777	4·80	5·60
North Arcot.	3,170,934	1,157,691	1,418,010	4·14	5·22
Chingleput ...	1,896,657	752,135	949,545	4·18	5·16
Madras ...	17,210	...	...	...	...
South Arcot.	2,693,301	1,323,053	1,531,344	3·61	5·81
Salem ...	4,423,953	1,662,495	1,907,856	6·51	12·62
Coimbatore. .	4,627,999	2,043,596	2,313,859	9·69	11·60
Trichinopoly.	2,767,685	1,422,848	1,558,276	5·63	7·57
Tanjore ...	2,389,404	1,341,654	1,461,774	4·80	6·62
Madura ...	3,203,034	1,437,827	1,599,094	5·80	7·07
Rāmnād ...	2,096,808	1,422,106	1,473,056	4·76	9·92
Tinnevelly ...	2,552,391	1,267,762	1,497,514	5·40	7·61
Nilgiris ...	651,226	76,493	80,020	20·00	15·33
Malabar ...	3,708,685	1,370,295	1,663,117	6·43	38·16
Anjengo ...	375	336	336	...	...
South Kanara.	2,573,445	557,261	759,094	8·28	3·15
Total for the Presidency.	89,699,386	34,056,060	38,821,332	...	...

TABLE SHOWING THE AVERAGE RAINFALL OF THE DISTRICTS OF THE MADRAS PRESIDENCY.

District.	Dry weather January-March.	Hot weather April-May.	South-west monsoon June to September.	North-east monsoon October to December.	Total rainfall.
Ganjām ...	1·65	3·88	30·26	10·18	45·97
Vizagapatam ...	1·35	3·74	25·13	10·59	40·81
Gōdāvari ...	0·78	2·62	25·39	10·61	39·40
Kistna ...	0·72	2·04	24·21	8·85	35·82
Guntūr ...	0·78	1·98	18·52	10·11	31·39
Nellore ...	1·25	1·66	11·29	21·64	35·84
Kurnool ...	0·34	1·85	17·69	5·68	25·56
Bellary ...	0·30	2·70	14·25	5·41	22·66
Anantapur ...	0·29	2·65	13·28	6·43	22·65
Cuddapah ...	0·55	2·07	15·15	9·94	27·71
North Arcot ...	1·14	3·73	17·84	15·03	37·74
Chingleput ...	1·33	2·14	16·37	25·55	45·39
South Arcot ...	1·46	2·93	16·93	24·08	45·40
Salem ...	1·04	5·55	14·86	10·95	32·40
Coimbatore ...	1·19	5·34	8·34	11·29	26·16
Trichinopoly ...	1·17	4·97	11·59	14·48	32·21
Tanjore ...	2·07	3·17	12·44	26·50	44·18
Madura ...	1·75	5·12	8·84	14·94	30·65
Rāmnād ...	2·19	3·66	6·08	17·04	28·97
Tinnevelly ...	3·22	3·28	3·10	17·79	27·39
The Nilgiris ...	3·59	8·90	36·49	20·11	69·09
Malabar ...	1·23	11·13	89·16	15·24	116·76
South Kanara ...	0·36	7·43	125·64	11·84	145·27
Chittoor ...	1·06	3·14	14·70	14·11	33·01
Madras ...	1·51	2·20	15·88	31·12	50·71

TABLE SHOWING THE NORMAL PRICE OF FOOD GRAINS PER IMPERIAL MAUND (82 LB.) DURING THE AGRICULTURAL YEAR 1917–18.

Group.	District.	Rice (second crop).	Ragi.	Cholam.	Cumbu.
		RS. A.	RS. A.	RS. A.	RS. A.
Circars ...	Ganjām	5 0	2 11	...	...
	Vizagapatam ...	5 0	2 11	...	2 11
	Gōdāvari	4 7	2 11	2 11	...
	Kistna	5 0	2 14	3 5	...
	Guntūr	4 7	...	3 1	2 14
Deccan ...	Kurnool	5 0	...	2 8	3 1
	Bellary	5 11	..	2 11	...
	Anantapur ..	5 0	2 8	2 11	2 11
	Cuddapah ...	5 0	2 11	2 11	2 14
Carnatic...	Nellore	4 7	2 11	2 14	2 14
	Chingleput ...	5 0	3 5	...	...
	Madras	5 11	3 1	..	...
	South Arcot ..	5 0	3 1	...	3 5
Central ..	Chittoor	4 7	2 14	..	3 1
	North Arcot ...	5 0	2 14	...	3 1
	Salem	5 11	2 14	3 1	3 1
	Coimbatore ...	5 11	3 1	3 1	3 5
	Trichinopoly ..	5 0	2 14	3 1	3 5
South ...	Tanjore	5 0	3 1	...	...
	Madura	5 0	2 14	3 5	3 5
	Rāmnād	5 0	2 14	3 1	3 10
	Tinnevelly ..	5 0	2 14	2 14	3 10
West Coast.	Malabar	5 0	...	...	...
	South Kanara ...	4 7	...	...	...
Hills ...	The Nilgiris ...	5 11	3 5	..	...

AVERAGE YIELD (POUNDS PER ACRE) OF PRINCIPAL CROPS IN EACH DISTRICT OF THE MADRAS PRESIDENCY.

District.		Paddy.	Cholam.	Cumbu.	Ragi.	Gingelly	Sugar cane (jaggery).	Cotton (cleaned).
Ganjām ...	Irrigated ...	1,300	1,200	1,200	1,000	280	5,000	50
	Unirrigated ...	800	700	650	700			
Vizagapatam	Irrigated ...	1,400	1,300	1,200	1,200	336	6,500	50
	Unirrigated ...	800	700	700	700			
Gōdāvari ..	Irrigated ...	2,000	1,300	1,200	1,200	336	7,500	75
	Unirrigated ...	900	700	630	800			
Kistna ...	Irrigated ...	1,900	1,300	1,200	1,400	336	7,500	75
	Unirrigated ...	1,000	700	630	800			
Guntūr ...	Irrigated ...	1,800	1,300	1,200	1,900	280	7,500	75
	Unirrigated ...	1,100	630	630	800			
Kurnool ...	Irrigated ...	1,600	1,400	1,200	1,600	224	4,500	50
	Unirrigated ...	1,000	630	550	650			
Bellary ...	Irrigated ...	1,700	1,500	1,300	1,000	224	6,000	50
	Unirrigated ...	900	450	450	450			
Anantapur...	Irrigated ...	1,700	1,400	1,200	1,550	224	4,300	50
	Unirrigated ...	800	430	400	600			
Cuddapah ...	Irrigated ..	1,800	1,500	1,300	1,650	224	6,000	50
	Unirrigated ..	900	630	700	600			
Nellore ...	Irrigated ...	1,550	1,300	1,300	1,650	280	6,000	75
	Unirrigated ...	1,100	600	700	600			
Chingleput	Irrigated ...	1,550	1,400	1,000	1,100	280	6,000	50
	Unirrigated ...	1,100	600	650	600			

South Arcot.	Irrigated ...	1,850	1,500	1,000	1,500	280	6,500	55
	Unirrigated ...	1,100	600	700	800			
Chittoor ...	Irrigated ...	1,900	1,500	1,200	1,800	280	7,300	50
	Unirrigated ...	1,000	600	650	700			
North Arcot.	Irrigated ...	1,900	1,500	1,100	1,550	280	6,000	55
	Unirrigated ...	1,000	600	650	800			
Salem ...	Irrigated ...	1,900	1,500	1,300	1,550	280	6,000	55
	Unirrigated ...	800	600	600	750			
Coimbatore.	Irrigated ...	1,900	1,500	1,200	1,700	280	7,500	55
	Unirrigated ...	800	600	400	800			
Trichinopoly.	Irrigated ...	1,900	1,500	1,200	1,400	336	5,000	55
	Unirrigated ...	1,000	500	500	650			
Tanjore ...	Irrigated ...	1,750	1,300	1,200	1,100	336	6,000	90
	Unirrigated ...	1,100	500	700	500			
Madura ...	Irrigated ...	1,950	1,400	1,000	1,400	280	6,000	90
	Unirrigated ...	900	600	450	650			
Rāmnād ...	Irrigated ...	1,800	1,400	1,000	1,500	280	4,500	90
	Unirrigated ...	1,100	400	400	400			
Tinnevelly.	Irrigated ...	2,000	1,500	1,000	1,600	280	4,500	90
	Unirrigated ...	1,000	350	450	500			
Malabar ...	Irrigated ...	1,400	700	600	1,500	224	6,000	50
	Unirrigated ...							
South Kanara.	Irrigated ...	1,500	...	...	1,000	280	6,400	50
	Unirrigated ..							
Nilgiris ...	Irrigated ...	1,800	500	...	1,000	280	6,000	...
	Unirrigated ...							

TABLE SHOWING THE CROPPING OF THE DISTRICTS OF THE MADRAS PRESIDENCY.

Crops.	Acreage under crops in the Madras Presidency during the agricultural year 1917-18.								
	Anantapur.	Anjengo.	Bellary.	Chingleput.	Chittoor.	Coimbatore.	Cuddapah.	Ganjam.	Godavari.
1	2	3	4	5	6	7	8	9	10
	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.
CEREALS—									
Paddy	201,149	...	41,565	655,634	229,220	92,906	135,681	1,214,219	643,700
Sorghum	234,530	...	707,751	11,301	29,092	504,364	327,603	2[illegible],374	90,532
Spiked Millet ...	124,725	...	82,473	13,4[illegible]2	170,4[illegible]2	461,2[illegible]3	121,[illegible]69	30,4[illegible]1	32,954
Ragi	88,953	...	26,1[illegible]1	7[illegible],936	163,[illegible]23	200,337	81,493	270,107	2[illegible],704
Paspalum Scrobiculatum.	23,929	...	2,350	37,153	23,415	5,769	25,816	849	2,720
Italian Millet ...	273,946	...	572,362	724	3,643	22,212	80,938	24,227	5,493
Panicum Miliare ...	61,495	...	19,120	65	9,933	117,817	4,137	31,931	8,312
Maize	9	...	67	1	4	87	...	19,156	2,963
Wheat	834	...	3,331	...	355	318	309	292	345
PULSES—									
Bengal gram	5,734	...	16,187	17	132	4,491	3,087	1,014	9,435
Horse gram	367,363	...	111,140	5,053	72,903	223,4[illegible]2	66,135	60,092	62,393
Red gram or dholl ...	13,529	...	34,260	205	3,343	13,[illegible]63	569	39,716	6,969
Green gram	2,118	...	15,730	474	903	5,553	2,011	125,953	33,319
Black gram	3	...	16	2,457	970	11,544	174	15,655	25,226
Others (Cereals and Pulses).	2,976	...	18,503	2,110	53,343	188,622	8,086	135,623	24,046
CONDIMENTS AND SPICES—									
Chillies	6,487	...	9,092	3,172	5,090	14,609	4,125	2,842	16,494

Onions and garlic ...	2,595	...	2,016	140	938	4,367	2,493	1,290	6,762
Coriander	2,830	...	2,145	...	811	2,396	3,651	192	2,186
Turmeric	239	...	17	172	709	2,952	4,361	16,395	774
Others	4,859	...	2,050	442	6,540	819	3,756	13,607	1,551
ORCHARD AND GARDEN PRODUCE.	9,110	336	14,653	55,957	32,013	26,642	18,253	61,671	76,079
OIL-SEEDS—									
Gingelly or til ...	27,197	...	18,554	32,196	4,757	16,409	3,422	53,593	78,469
Castor	93,914	...	52,334	61	16,351	13,705	16,816	4,872	5,630
Groundnuts	168,857	...	54,495	25,296	27,925	93,273	62,944	16,750	114
Others	8,519	...	11,118	306	7,221	59	2,143	45,806	338
SUGAR PRODUCE—									
Sugarcane	4,405	...	11,423	82	11,821	11,305	209	5,180	11,658
Others	13,302	...	339	716	1,678	522	1,265	60	403
FIBRES—									
Cotton	176,865		526,000	21	631	362,506	131,856	1,875	7,449
Hibiscus Cannabinus.									
Sunnhemp	25	...	506	763	33	394	...	3,111	15,370
Others	60	...	212	...	174	189	212	572	452
DYES—									
Indigo	9,975	...	6,669	16,506	14,355	8	40,392	...	2,018
Others	203	...	401	29	4	...	...	1,100	5
DRUGS AND NARCOTICS—									
Tobacco	2,643	...	1,249	94	920	31,523	1,741	4,064	10,535
Betel vine	1,457	...	717	970	1,367	2,113	859	234	33
Others	2,942	...	32	...	43	1,053	142	85	2,841
FODDER CROPS AND OTHERS.	427	...	31	...	19	63	5	3,630	14,322
Total ...	1,993,734	336	2,365,184	949,545	843,777	2,313,859	1,156,618	2,113,652	1,230,709
Deduct area cropped more than once.	103,872	...	23,533	197,410	127,915	270,263	106,618	353,434	269,256
Net area cropped ...	1,884,862	336	2,336,651	752,135	715,862	2,043,596	1,050,000	1,760,218	961,453

TABLE SHOWING THE CROPPING OF THE DISTRICTS OF THE MADRAS PRESIDENCY—*cont.*

Crops.	Acreage under crops in the Madras Presidency during the agricultural year 1917-18.								
	Guntur.	Kistna.	Kurnool.	Madura.	Malabar.	Nellore.	The Nilgiris.	North Arcot.	Rammad.
	11	12	13	14	15	16	17	18	19
	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.
CEREALS—									
Paddy	400,875	1,192,042	92,041	322,814	877,247	440,815	5,945	504,415	355,464
Sorghum	396,576	265,247	676,324	342,444	158	439,647	92	41,647	105,781
Spiked Millet ...	260,679	78,969	76,661	63,151	3	111,211	...	176,065	130,342
Ragi	19,316	16,389	22,846	94,445	15,034	73,713	2,542	156,445	124,553
Paspalum Scrobiculatum.	3,091	8,406	103,432	104,145	...	94,404	21	76,855	120,397
Italian Millet ...	65,910	3,350	370,369	9,745	53	29,905	210	4,601	11,095
Panicum Miliare ...	5	1,553	1,423	103,537	19,411	1,854	4,743	32,944	20,303
Maize	33,420	19,059	123	223	139	...	23	563	234
Wheat	794	27	1,842	1,131	...	...	1,713	227	...
PULSES—									
Bengal gram	22,150	14,637	23,611	894	191	79	...	1,262	5,540
Horse gram	54,440	95,676	90,156	99,518	5,910	88,288	37	53,655	12,280
Red gram or dholl ...	22,317	6,018	13,883	9,778	2,166	1,054	1	21,256	4,731
Green gram	12,193	23,571	5,417	1,239	1,877	19,218	...	3,430	4,155
Black gram	965	22,250	3,603	7,209	5,562	2,694	...	10,333	5,374
Others (Cereals and Pulses).	327,870	11,325	44,045	23,692	10,215	34,880	8,362	9,884	54,532
CONDIMENTS AND SPICES—									
Chillies	85,949	11,847	23,730	7,441	,221	8,615	39	4,214	11,428

Onions and garlic ...	1,401	4,449	1,800	5,233	...	180	267	739	1,367
Coriander	60,071	7,360	415	525	...	74	16	853	7,929
Turmeric	4,190	1,157	1,295	213	5,954	263	...	514	7
Others	4, 94	709	7,570	8,354	85,023	2,413	95	4,007	4,567
ORCHARD AND GARDEN PRODUCE.	8,364	33,202	7,076	29,763	515,203	13,150	11,546	44,931	21,702
OIL-SEEDS—									
Gingelly or til ...	634	84,890	2,847	26,815	12,432	6,583	30	43,123	27,512
Castor	62,631	23,264	54,512	13,415	757	63 221	...	7,205	3,333
Groundnuts	3,623	955	77,593	53,043	476	2,165	...	173,403	34,233
Others	634	655	15,962	143	401	2	43	1,515	695
SUGAR PRODUCE—									
Sugarcane	12	523	1,531	3,618	168	4	3	3,453	559
Others	4,530	4,534	37	736	10,373	762	...	1,707	3,427
FIBRES—									
Cotton ... ... *Hibiscus Cannabinus.*	160,671	61,995	309,974	224,666	431	47,710	8	246	314,654
Sunnhemp	146,326	40,095	65	87	65	792	...	23	2
Others	11,461	3,466	6,423	332	...	1,004	22	146	5
DYES—									
Indigo	59,823	23,714	39,622	305	...	37,635	...	17,337	11
Others	32	26	7	567	...	...	...	12	...
DRUGS AND NARCOTICS—									
Tobacco	53,295	12,111	5,476	14,176	17	2,342	42	3,401	3,469
Betel vine	233	39	722	2,277	3,235	542	...	899	1,244
Others	349	3	...	10,915	86,316	29	44,202	443	1,752
FODDER CROPS AND OTHERS.	33,857	91,807	11	2,350	1,524	176	8	159	30,359
Total ...	2,333,706	2,170,425	2,062,449	1,599,094	1,663,117	1,525,519	80,020	1,413,062	1,473,056
Deduct area cropped more than once.	302,044	397,639	63,921	161,267	292,822	170,493	3,527	260,326	50,950
Net area cropped ...	2,036,662	1,772,786	1,998,523	1,437,827	1,370,295	1,355,026	76,493	1,157,736	1,422,106

TABLE SHOWING THE CROPPING OF THE DISTRICTS OF THE MADRAS PRESIDENCY—*cont.*

Crops.	Acreage under crops in the Madras Presidency during the agricultural year 1917-18.							
	Salem.	South Arcot.	South Kanara.	Tanjore.	Tinnevelly.	Trichinopoly.	Vizagapatam.	Total in hundreds.
	20	21	22	23	24	25	26	27
	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.	ACRES.
CEREALS—								
Paddy	226,420	509,197	602,096	1,123,499	313,3[illegible]7	290,651	1,1[illegible]4,320	11,655,3
Sorghum	114,235	49,467	...	14,[illegible]71	112,990	272,257	75,114	4, 90,4
Spiked Millet ...	431,463	163,522	...	16,067	212,322	304,2[illegible]2	1[illegible]6,42[illegible]	3,20[illegible],9
Ragi	342,336	121,947	6,173	26,824	44,216	112,09[illegible]	374,494	2,491,9
Paspalum Scrobiculatum.	86,393	160,387	...	63,106	23,2[illegible]5	176,126	13,034	1,160,5
Italian Millet ...	13,693	10,7[illegible]3	...	127	1,922	1,113	17,711	1,529,2
Panicum Miliare ...	119,613	1,870	101	170	88,617	20,912	88,625	759,6
Maize	669	...	...	176	85	14	19,049	101,1
Wheat	1,035	...	...	...	...	...	2,469	15,0
PULSES—								
Bengal gram ...	4,232	139	...	...	3,418	367	1,9[illegible]1	118,6
Horse gram	220,742	13,84[illegible]	23,251	2,547	85,2[illegible]4	39,537	[illegible]9,070	1,94[illegible],3
Red gram or dholl ...	17,000	6,5[illegible]0	250	12,6[illegible]3	3,[illegible]39	33,0[illegible]6	29,022	301,1
Green gram ...	10,367	72[illegible]	8,356	232	9,661	416	5[illegible],112	345,1
Black gram	13,15[illegible]	2,657	12,469	2,559	15,104	1,[illegible]12	21,[illegible]34	1[illegible]3,7
Others (Cereals and Pulses).	44,473	2,3[illegible]9	2,612	2,775	53,018	8,031	87,0[illegible]5	1,163,5
CONDIMENTS AND SPICES—								
Chillies	7,831	2,245	4,534	5,091	13,819	12,526	15,819	279,3

Onions and garlic ...	1,458	852	6	212	3,440	2,003	5,957	50.1
Coriander	6,562	3,864	...	520	13,464	23,021	60	132.0
Turmeric	1,279	820	...	1,045	140	5,534	3,450	51.5
Others	3,975	...	5,915	2,304	455	...	6,426	170.3
ORCHARD AND GARDEN PRODUCE.	24,677	33,629	67,532	67,593	41,361	30,290	65,691	1,315.4
OIL-SEEDS—								
Gingelly or til ...	48,174	43,859	2,661	18,139	69,353	39,790	165,293	831.7
Castor	25,593	913	173	541	1,-97	13,500	9,023	433.7
Groundnuts	75,343	332,791	9	77,751	523	95,187	27,940	1,415.2
Others	1,056	871	62	6,318	233	30	92,270	196.5
SUGAR PRODUCE—								
Sugarcane	6,627	11,417	2,841	731	292	8,612	31,165	127.6
Others	1,193	1,083	362	2,592	40,333	327	1,165	91.7
FIBRES—								
Cotton ... ... *Hibiscus Cannabinus.*	26,339	2,956	164	2,051	273,379	49,541	17,979	2,700.5
Sunnhemp	726	66	94	373	473	34	14,606	224.1
Others	141	197	120	15	...	196	46,543	71.9
DYES—								
Indigo	2,505	41,230	...	471	326	5,046	1,439	324.4
Others	173	...	...	363	213	97	119	3.4
DRUGS AND NARCOTICS—								
Tobacco	5,573	2,310	1,435	2,214	911	5,151	37,822	207.6
Betel vine	2,346	722	853	2,325	1,596	1,240	144	26.3
Others	8,876	31	16,052	62	...	36	303	177.0
FODDER CROPS AND OTHERS.	8,464	333	963	392	55,336	403	16,100	265.8
Total ...	1,907,866	1,531,344	759,094	1,461,774	1,497,514	1,553,276	2,807,664	33,821.4
Deduct area cropped more than once.	245,020	203,291	201,833	120,120	229,752	135,423	459,204	4,764.9
Net area cropped ...	1,662,836	1,323,053	557,261	1,341,654	1,267,762	1,422,848	2,348,460	34,056.4

CALENDAR.

LIST OF TAMIL, TELUGU, KANARESE AND MALAYALAM MONTHS CORRESPONDING WITH ENGLISH MONTHS.

English.	Tamil.	Malayalam.	Telugu Kanarese.	Karthulu (Telugu).	English.
				Uttrashada ...	January 10—22.
				Sravanam ...	January 23—February 4.
Jan. 16—Feb. 15 ...	Thai ...	Makaram ...	Pushyam ...	Dhanishta ...	February 5—17.
				Satabhisha ...	February 18—March 2.
Feb. 16—Mar. 15...	Masi ...	Kumbham ...	Magham ...	Purvabhadra...	March 3—15.
				Uttarabhadra.	March 16—27.
Mar. 16—Apr. 15...	Panguni ...	Meenam ...	Phalghunam.	Revati ...	March 28—April 10.
				Asvani ...	April 11—25.
Apr. 16—May 15...	Chittirai ...	Medan ...	Chaitram ...	Bharani ...	April 26—May 9.
				Krittika ...	May 10—23.
May 16—June 15...	Vaiyasi ...	Idavam ...	Vaisakham ...	Rohini ...	May 24—June 6.
				Mrugasira ...	June 7—22.
June 16—July 15...	Ani ...	Mithunam ...	Jeshtam ...	Arudra ...	June 23—July 4.
				Punarvasu ...	July 5—18.
July 16—Aug. 15...	Adi ...	Karkitaka ...	Ashadham ...	Pushya ...	July 19—August 1.
				Aslesha ...	August 2—15.
Aug. 16—Sep. 15...	Avani ...	Chingam ...	Sravanam ...	Maka ...	August 16—29.
				Pubba ...	August 30—Sep. 11.
Sep. 16—Oct. 15...	Purattasi ...	Kanni ...	Bhadrapada.	Uttara ...	September 12—25.
				Hasta ...	September 26—Oct. 8
Oct. 16—Nov. 15...	Appisi ...	Thulam ...	Asweejam ...	Chitra ...	October 9—22.
				Swati ...	October 23—Nov. 4.
Nov. 16—Dec. 15...	Kartigai ...	Vrichikam ...	Kartigam ...	Visakha ...	November 5—17.
				Anoradha ...	November 18—30.
Dec. 16—Jan. 15 ...	Margali ...	Dhanu ...	Margasiram ...	Jeshta ...	December 1—14.
				Mula ...	December 15—27.
				Purvashadha...	December 28—January 9.

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