Facts and figures for the man on the land

J A. Mallett
FARM or station life calls for the exercise of so many different skills that the farmer or pastoralist is usually an accomplished handyman. For those whose schooldays are far behind them however, the most difficult part of many tasks is that of dealing with the calculations involved, and it is hoped that these facts and figures will serve as a handy aid to those whose mathematical ability has not kept pace with their manual and technical skill.

MEASURES OF LENGTH

The basis of most British measurements of length is the Imperial Linear Measure given below:

- 12 inches = 1 foot.
- 3 feet = 1 yard.
- 5 1/2 yards = 1 pole, rod or perch.
- 40 poles = 1 furlong.
- 8 furlongs = 1 mile.

There are many other lesser-known units of length, some of which are obsolete or are reserved for special purposes.

The Point (1/72nd of an inch) and the Line (1/12 of an inch) are seldom used outside the printing trade.

The Hand (4 in.) is used in measuring the height of a horse at the withers. Like the Span (9 in.), and the Palm (3 in.) this was originally a rough measurement using the human hand. The Cubit (about 18 in.) was another old measurement using the forearm from the elbow to the tip of the middle finger.

The Fathom (6 ft.) is used in soundings for measuring the depth of water, and is also used in measuring ropes and cordage.

The Furlong (220 yds. or 10 chains) is one-eighth of a mile. The name was originally “furrow-long,” an Old English term. It is believed to be the approximate distance a span of oxen travelled in ploughing before they were halted for a “breather.”

The Mile of 1,760 yds. is the English Statute mile. The name comes from the old Roman unit of length which was 1,000 (mille) double paces. The Nautical or Geographical Mile is one minute of longitude measured along the Equator (6082.66 ft.) or 2027.55 yds. but in British practice it usually refers to the Admiralty Measured Mile of 6,080 ft. or 2026.66 yds. The term knot is a unit of speed and refers to nautical miles per hour.

The League (3 miles) is a measure that is seldom used today.

SURVEYOR’S UNITS

In land surveying, the Gunters Chain Measure is used. This measuring chain was introduced by Edmund Gunter, inventor and astronomer who lived from 1581 to 1626. The chain is 22 yds. or 4 poles long and is made up of 100 links each 7.92 in. long.

- 7.92 inches = 1 link.
- 100 links = 1 chain.
- 10 chains = 1 furlong.
- 80 chains = 1 mile.

MEASURES OF AREA

The Imperial Square Measure given below is standard for most surface and land measurements in British Commonwealth countries:
144 square inches = 1 square foot.
9 square feet = 1 square yard.
30\(\frac{1}{4}\) square yards = 1 square pole.
40 square poles = 1 rood.
4 roods = 1 acre.
640 acres = 1 square mile.

ALL ABOUT AN ACRE

An acre contains:
- 6,272,640 square inches.
- 100,000 square links.
- 43,560 square feet.
- 4,840 square yards.
- 160 square poles.
- 10 square chains.
- 4 roods.

and there are 640 acres in a square mile.

Judging an Acre.—An area measuring 70 yds. by 70 yds. is approximately an acre. Such an area contains 4,900 sq. yds. or 60 sq. yds. more than the 4,840 sq. yds. of a measured acre.

Rainfall per Acre.—One inch of rain deposits 6,272,640 cubic inches of rain on an acre of land. This means 3,630 cubic feet or—taking the commonly accepted figure of 6\(\frac{1}{2}\) gallons per cubic foot—the inch of rain would deposit 22,687 gallons of water on each acre. A gallon of water weighs 10 lb. and a cubic foot of water (6\(\frac{1}{2}\) gals.) weighs 62\(\frac{1}{2}\) lb. so the inch of rain puts approximately 101 tons of water on each acre.

Implement Travel Per Acre.—Farmers often wish to know how far a certain implement must travel to cover an acre. A simple method is to divide 660 by the width of cut in feet. This gives the number of chains the implement must travel to cover an acre. For example, a 10 ft. implement would have to travel 66 chains; an 8 ft. machine 82\(\frac{1}{2}\) chains; a 6 ft. machine 110 chains and so on.

MEASURES OF VOLUME AND CAPACITY

SOLID OR CUBIC MEASURE
- 1,728 cubic inches = 1 cubic foot.
- 27 cubic feet = 1 cubic yard.

LIQUID MEASURE
- 4 gills = 1 pint.
- 2 pints = 1 quart.
- 4 quarts = 1 gallon.

DRY OR CORN MEASURE
- 2 gallons = 1 peck.
- 4 pecks = 1 bushel.
- 8 bushels = 1 quarter.

The Pint contains 20 fluid ounces. A fluid ounce of water weighs 1 oz. avoirdupois so that a pint of fresh water would weigh 1\(\frac{1}{2}\) lb.

The Gallon.—The standard Imperial gallon introduced in 1824, contains 277.27 cubic inches and holds 10 lb. of distilled water with the barometer at 30 inches and the thermometer at 62 degrees Fahrenheit.

The U.S.A. gallon contains 231 cubic inches and holds 8.33 lb. of water so that 71 U.S.A. gallons are approximately equal to 59 Imperial gallons.

The Bushel.—The Imperial bushel contains 8 gallons, 1.28 cubic feet or 2219.3 cubic inches. The U.S.A. or Winchester bushel contains 2150.4 cubic inches.

The bushel is a measure of volume or capacity, not of weight. A bushel of wheat, for instance was originally the quantity of wheat required to fill a bushel measure. The size and density of the grains the percentage of moisture content, the degree of admixture of such things as chaff, weed seeds, dust, etc., could obviously cause fairly wide variations in the actual weights of a series of measured bushels of wheat from different sources. The weight of a measured bushel of apples, bran, oats or barley would differ from the weight of a measured bushel of wheat.

For convenience in trading, certain weights have been accepted as approximating the average weight of a bushel of various forms of farm produce.

Some of the common examples are given below:

<table>
<thead>
<tr>
<th>Item</th>
<th>lb.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apples</td>
<td>42</td>
</tr>
<tr>
<td>Beans (dry)</td>
<td>60</td>
</tr>
<tr>
<td>Beans (French, green)</td>
<td>20</td>
</tr>
<tr>
<td>Bran</td>
<td>20</td>
</tr>
<tr>
<td>Grass Seeds</td>
<td>20</td>
</tr>
<tr>
<td>Lemons</td>
<td>56</td>
</tr>
<tr>
<td>Lucerne Seed</td>
<td>60</td>
</tr>
<tr>
<td>Maize</td>
<td>60</td>
</tr>
<tr>
<td>Millet</td>
<td>60</td>
</tr>
<tr>
<td>Oats</td>
<td>40</td>
</tr>
<tr>
<td>Peas (Field, dry)</td>
<td>60</td>
</tr>
<tr>
<td>Pollard</td>
<td>20</td>
</tr>
<tr>
<td>Wheat</td>
<td>60</td>
</tr>
</tbody>
</table>
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(Department of Agriculture)

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(b) Junior Standard Bookkeeping.

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Duration of Course.—Two years.

Fees.—Approximately £180 per annum covering full residential charges.

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MEASURES OF WEIGHT

The Avoirdupois Table of weights, given below, is used in most commercial transactions throughout the British Commonwealth of Nations.

16 drams (dr.) = 1 ounce (oz.).
16 ounces = 1 pound (lb.).
14 pounds = 1 stone (st.).
2 stones = 1 quarter (qr.).
4 quarters = 1 hundredweight (cwt.).
20 hundredweights = 1 ton.

The Ton (2,240 lb.) is sometimes referred to as the “long ton” to distinguish it from the “short ton” or “U.S.A. ton” (2,000) used in flour sales.

The Cental (100 lb.) is another unit of weight often quoted in overseas grain and flour sales.

The Quintal is a term with variable meanings. In the U.S.A. it is 100 lb.; in Britain 112 lb. or 1 cwt.; and in the Metric system it means 100 kilogrammes (220.46 lb.).

TROY WEIGHT

Gold, silver and precious stones are weighed by the Troy Weight given below—
24 grains (gr.) = 1 pennyweight (dwt.).
20 pennyweights = 1 ounce (oz.).
12 ounces = 1 pound (lb.).

The Carat (3.2 gr. Troy) is used in weighing diamonds, but a carat of gold, used as a measure of fineness, is 10 dwts. (a twenty-fourth part of 1 lb. Troy). All alloyed gold is regarded as being divided into 24 equal parts so that 18 carat gold is 18 parts of pure gold to 6 parts of alloy (usually copper) 12 carat is 12 parts of pure gold to 12 parts of alloy, and 9 carat, is 9 parts of gold to 15 parts of alloy.

APOTHECARY’S MEASURES

Although drugs are bought and sold by Avoirdupois weight, prescriptions are dispensed by the Apothecary’s weights and measures given below—

Weights
20 grains (gr.) = 1 scruple (sc.).
3 scruples = 1 drachm (or dram.).
8 drams = 1 ounce.

Fluid Measure
60 minims = 1 fluid drachm.
8 fluid drachms = 1 fluid ounce.
20 fluid ounces = 1 pint.

A Minim is approximately one drop, although measurement by drops is neither safe nor accurate. The consistency of the liquid and the size and shape of the neck of the bottle can cause wide variations in the size of the drops.

Household Measures.—Because of the varying size of household utensils they should not be used for measuring medicines. A graduated medicine glass marked off in teaspoonfuls, dessertspoonfuls and tablespoonfuls may be purchased cheaply.

A medicinal teaspoonful = 1 fluid drachm.
A medicinal dessertspoonful = 2 fluid drachms.
A medicinal tablespoonful = ¼ fluid ounce.

Coins as Weights and Measures

A halfpenny is one inch in diameter.
Three pennies weigh one ounce.
A halfpenny and a threepenny piece weight ⅙ oz.
A florin and a sixpence weigh ½ oz.
(The weights of coins are taken on coins that are neither brand-new nor badly worn.)

THE METRIC SYSTEM

The metric system, in which all the weights and measures are in fractions or multiples of ten, has obvious advantages and has been adopted by many countries throughout the world.

The metric system is based upon the “metre” which is one ten millionth part of the distance from the Equator to the North Pole on the meridian of Paris. The metre equals 39.371 inches and is the basic unit of length.

Similarly, the unit of area or square measure is the “are” (a surface measuring 10 metres x 10 metres).

The metric table of weights is based on the “gramme” which is the weight of water (at its greatest density) which could be contained in a cubical vessel with sides measuring one-hundredth part of a metre (one centimetre).

The metric unit of volume or capacity is the “litre” which is the contents of a cubical vessel with sides measuring one-twentieth part of a metre (one decimetre).

The Latin prefixes deci, centi, and milli are used to denote fractions or parts of the

1001
units (a tenth, a hundredth and a thousandth respectively).

The Greek prefixes "deca, hecto, kilo and myria" are used to denote multiples of the units (ten, a hundred, a thousand and ten thousand times respectively).

Approximate British equivalents are given in brackets alongside the main metric weights and measures.

**LENGTH (Metric)**

- 10 Millimetres = 1 Centimetre (0.394 in.).
- 10 Centimetres = 1 Decimetre (3.937 in.).
- 10 Decimetres = 1 METRE (39.371 in.).
- 10 Metres = 1 Decametre (10.936 yds.).
- 10 Decametres = 1 Hectometre (109.363 yds.).
- 10 Hectometres = 1 Kilometre (1,093 yds.).

**WEIGHT (Metric)**

- 10 Milligrammes = 1 Centigramme (0.154 grains).
- 10 Centigrammes = 1 Decigramme (1.543 grains).
- 10 Decigrammes = 1 GRAMME (15.432 grains).
- 10 Grammes = 1 Decagramme (154.323 grains).
- 10 Decagrammes = 1 Hectogramme (3.527 oz.).
- 10 Hectogrammes = 1 Kilogramme (2.205 lb.).
- 100 Kilogrammes = 1 Quintal (1.968 cwts.).
- 10 Quintals = 1 Tonne (0.984 ton).

**CAPACITY (Metric)**

- 10 Millilitres = 1 Centilitre (0.017 pints).
- 10 Centilitres = 1 Decilitre (0.176 pints).
- 10 Decilitres = 1 LITRE (1.761 pints).
- 10 Litres = 1 Decalitre (2.201 gals.).
- 10 Decalitres = 1 Hectolitre (22.009 gals.).

**SOME FACTS ABOUT WATER**

Water covers approximately four-fifths of the surface of the globe and makes up a similar proportion of the total mass of animal and vegetable matter on the earth.

It boils at—
- 212 degrees Fahrenheit.
- 100 degrees Centigrade.
- 80 degrees Reaumur.

It freezes at—
- 32 degrees Fahrenheit.
- 0 degrees Centigrade.
- 1 degree Reaumur.

When water is cooled, it shrinks in volume until it reaches a temperature of 4 degrees Centigrade (which equals 39.2 degrees Fahrenheit). It then commences to increase in volume as the temperature is lowered and, when the formation of ice takes place at 0 degrees Centigrade (32 degrees Fahrenheit), a considerable expansion—equal to about one-eleventh of the bulk of the water—takes place.

**Weight of Water.**—An easily-memorised jingle is—

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

A gallon of water weighs 10 lb.

A cubic foot of water contains 61 gallons (approx.) and weighs 62½ lb. (1,000 oz.) if fresh or about 64 lb. (1,024) oz. in the case of sea water.

It takes approximately 11 gals. of water to weigh a hundredweight or 224 gals. to weigh a ton.

A fluid ounce of water weighs 1 ounce Avoirdupois.

**Rainfall.**—An inch of rain deposits about 22,687 gallons or 101 tons of water on each acre of ground. For convenience, it is usually calculated at 22,400 gallons or 100 tons per acre-inch.

**Farm Water Supplies.**—The ideal water supply is one in which the water is clear, sparkling and odourless, free from disease-producing organisms and from mineral salts which cause "hardness."

Rainwater closely approaches the ideal but is not normally available in sufficient quantities to supply all requirements of livestock, etc.

Surface waters such as are found in streams, lakes and farm dams are usually fairly free from mineral salts but may contain substances which cause them to be cloudy or discoloured.

Underground waters from wells and bores vary widely in their mineral contents and are often unsuitable for human consumption but may be quite satisfactory for livestock.

**Water for Livestock.**—No hard-and-fast rules can be laid down regarding the permissible quantities of mineral salts in stock waters but a useful and easily-memorised guide is that "Good" stock water contains less than 300 grains of total salts per gallon. Water containing up to 600 grains could be classed as "Fair" and anything with over 600 grains as "Bad."
In practice there are wide variations in the tolerance of stock to mineralised waters. Stock on ample green feed for instance can withstand higher concentrations of mineral salts than those on dry feed. Where evaporation from a dam gradually increases the saline content of the water stock may continue to thrive although new stock, used to fresh water, would be injuriously affected if suddenly switched to such a source.

Sheep are more tolerant than cattle and horses and have been known to remain healthy when drinking water containing over 1,000 grains per gallon of total salts. Maximums often quoted for other stock are, 700 grains for beef cattle, 500 grains for dairy cattle, 450 grains for horses, 300 grains for pigs and 200 grains for poultry.

Dry stock and adult animals can usually tolerate saline water better than lactating animals and young stock.

Mineral Salts.—About three-quarters of the total salts in the water of the agricultural areas in Western Australia consist of sodium chloride (common salt). The proportion of common salt is less in the pastoral areas and northern part of the State.

Other salts include gypsum (calcium sulphate), epsom salts (magnesium sulphate), Glauber's salts (sodium sulphate) and other salts of soda, lime and magnesia.

For human beings a maximum total salts content of 150 grains per gallon is usually quoted. The total salts content of the water supply for the metropolitan area varies according to locations and seasons. That from the Hills reservoirs has about 15 grains to the gallon but in certain seasons this supply is augmented by bore water carrying up to 80 grains.

Sea water carries about 2,500 grains to the gallon of which about 1,900 grains is common salt.

About 220 grains of total salts per gallon is regarded as the maximum for safe watering of plants but where such a concentration is used there should be good drainage and waterings should be sufficient to leach accumulated salts below the root zone.

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