**Canterbury Chamber of Commerce**

*Agricultural Bulletin*

# FARM WATER SUPPLY—PURE WATER FOR THE FARM

*Prepared by Canterbury Agricultural College, Lincoln*

BULLETIN CHRISTCHURCH, JULY, 1935 No. 73

A clean and wholesome water supply for human and animal consumption is equally important to the town dweller and farmer. The former is supplied with a sanitary and wholesome supply; the latter has to make suitable arrangements for himself. In Bulletin No. 72, rams, pumps, and the delivery of water were discussed. In this bulletin attention will be devoted to the cleanliness and wholesomeness of the water supply.

The source from which water is obtained has a distinct bearing on its purity, palatability, and its suitability for consumption for household and for dairy purposes. For human and animal consumption the water should be free from disease-producing bacteria and organisms which may impair the health, while for dairy purposes, it should also be free from yeasts, fungi, and bacteria which are responsible for many of the common abnormal changes in milk and dairy products. An impure water supply makes it difficult for a dairy farmer to produce high quality products.

### Different Kinds of Water

The characteristics of water from a particular source are influenced largely by local conditions, but water from similar sources have many characteristics in common and these are briefly described.

1. Stored Rain Water.—This varies according to the purity of the atmosphere, the nature of the collecting surface, the frequency of rains, and the storage system. Thus roof water is commonly polluted with bird droppings, leaves, and soot, while surface water from a natural or artificial catchment area is usually contaminated to a greater or less degree, depending upon the cleanliness of the surface. A device to discard the first water after rain can be fitted to the down-pipe.

2. Shallow Well Water.—Water in these wells is liable to seepage from the surface through open, porous subsoils. Sewage, drainage from farmyards, and other objectionable surface water may pollute shallow wells unless they are constructed as far away as possible from the source of contamination and at a higher level. The ground round the well should be built up to prevent the entrance of surface drainage into the well. This source of supply should be avoided where possible.

3. Deep Well Water.—Water in these wells has to pass through one or more strata of good filtering material and as a result of natural filtration the water supply is fairly pure. It is important to keep surface water out of deep wells by careful construction. Deep well water frequently contains salts which were accumulated in its passage through the soil, and these may cause the water to be "hard."

4. Race Water.—For stock consumption this water must always be considered as a possible source of contamination for disease and worm parasites. For human consumption it is essential that it be filtered owing to the risk of it containing disease bacteria and hydatid material. For dairy purposes it is a very unsatisfactory source of water supply. In summer time it is practically useless for cooling purposes, and the many sources of contamination to which it is exposed render it unsafe unless it is filtered or sterilised.

5. Stream and River Water.—The purity of this supply depends upon the nature of the country through which the stream passes. In uninhabited hill country it will be pure, while in inhabited country it may be contaminated with the discharge from domestic and industrial sewage, dead animals, and dip discharge, and thus be highly dangerous. Although dilution and long exposure to the sun and air are potent factors in purifying such water, this should not be relied upon. A case is known of a river being polluted 12 miles from the source of contamination. Dip discharge should drain into a rubble sump (36 cubic feet per 100 gallons of dip), located some distance from the water supply. Where this is done it is unusual for arsenic to percolate more than a few inches from the sump. Mixing with lime or ferrous sulphate renders arsenical dips inert.

It is impossible to form a reliable opinion as to the quality of the water from its appearance and taste. If any doubts exist the health authorities should be communicated with, with regard to methods of sampling for examination.

### Protection of Water From Animals and Disease

The harmful effects of drinking impure water are less common in animals than in human beings. In man, epidemics of cholera, enteric, typhoid, dysentery, etc., have from time to time been traced to polluted water supplies. In animals, the possibilities of spread of diseases such as contagious abortion of cattle, Johne's disease, tuberculosis, strangles, and influenza of horses, etc., must also be entertained. Another risk of infection for both man and animals is contamination with worm eggs or parasitic larval forms. Hydatid disease for example may be spread by the water supply. Other diseases that may be spread or perpetuated by unsuitable watering facilities for stock are stomach and lung worms of horses, cattle, sheep, pigs or poultry. Moist or wet conditions favour the longevity of these parasites and favour the development of snails and slugs, which are intermediate hosts for certain of them. Outbreaks of "the little red worm" in young horses and round worm infestation of pigs, a common trouble in New Zealand, have been traced to the drinking of water from shallow ponds or other unsuitable drinking places which have been subject to heavy pollution with infested animal manure.

Improved watering facilities therefore will do much to reduce the risks of spread of disease, in particular, worm infestation, and the need for keeping the water supply protected from dogs is important for the control of hydatids. (See Bulletin No. 67.) Where possible suitably raised troughs should be installed for all classes of stock and an efficient drainage system adopted for the removal of surplus and waste water. For worm control in pigs this is a matter which is often neglected. The wallow water is often the only source of supply for these animals. Separate drinking buckets should be used for animals affected with infectious diseases. The careful horseman sometimes uses his own watering bucket to avoid risk of infection from public drinking troughs.

### Bacteria in Water and Their Effects on Dairy Products

For general farm purposes many polluted waters are probably harmless, but it must be realised that some risk is always attached to the use of such waters. For domestic and for dairy purposes pure water is essential. In addition to the risk of introducing disease-producing bacteria in milk, polluted water has frequently been responsible for abnormal changes in milk and cream. While pigmentation of milk, slimy and ropy milk, fermentation of cream, and the development of bad flavours may be the result of various kinds of contamination, they have periodically been traced to the presence of yeasts, moulds, and bacteria in the water supply. The remedy lies in efficient purification of the water supply and suitable protection after purification.

### Methods of Purifying Water

1. Filtration.—One of the most satisfactory methods of ensuring a sanitary water supply is to filter the water. A filter purifies water principally through adherence of contained particles to an adhesive surface. The grains of sand, after they have become coated with a natural gelatinous film, provide a large adhesive surface, and for this reason sand is one of the most suitable materials for large filters. A convenient size of filtering plant which will deliver about 300 gallons a day consists of a concrete tank three feet six inches square and five feet deep. At the bottom of this are four-inch field tiles covered by nine inches of clean gravel and then two feet three inches of clean sand. The surface of the filter must be kept covered with water, which percolates through the sand and is collected by the field tiles. It then gravitates or is pumped to a storage tank. Where the water supply is muddy it should be stored for several days in a settling tank prior to filtering. In time the filter becomes clogged, and when this occurs the sand should be removed, cleaned, and replaced.

2. Chemical Sterilisation.—When water for dairy purposes is derived from suspicious sources such as shallow wells or races it may be more convenient to sterilise it than to filter it. This should always be preceded, however, by some form of filtration or sedimentation to remove the coarser particles of organic matter which hinder efficient sterilisation. The sterilising agent should be non-poisonous, non-corrosive, and should not impart any objectionable taste to the water.

Chlorination of the water supply is a simple and economical method but requires careful control since the strength of bleaching powder varies considerably. The method is not suitable for water with large quantities of iron or organic matter. The chlorine is added either in the form of bleaching powder, the hypochlorate or the gas to give about half a part of chlorine a million parts of water. This is equivalent to 10-15lb of bleaching powder a million gallons of water, or about a salt spoonful to 500 gallons. The bleaching powder should first be mixed in a bucket of water and then thoroughly stirred throughout the supply and 10-12 hours should be allowed for the chlorine to act. Certain impurities in the water may be responsible for an objectionable taste in chlorinated water, but if it exists it can be removed by the addition of Condy's crystals at the rate of two pounds a million gallons (i.e. about half a dozen crystals to 500 gallons), or by the addition of half as much "hypo" as bleaching powder used. The water is ready for use one to two hours later.

### Hard and Soft Water

Although purity is one of the main essentials of a good water supply its chemical composition also affects its suitability for certain purposes. The term "hard" is applied to those waters which do not readily form a lather with soap. This is due to the presence in the water of certain mineral salts of calcium and magnesium. Hard water has been held responsible for certain digestive troubles and malnutrition in animals; they are unsatisfactory for use in mixing sheep dips and certain disinfectants, and they form a scaly deposit in boilers and other containers in which water is boiled. Some waters can be softened by boiling, but this method is hardly applicable to farms. "Temporary hardness" of water which is due to the presence of bicarbonates of calcium and magnesium can be removed by the addition of slaked lime. This process also removes some of the organic matter from the water and thus helps to purify, as well as soften, the water. The removal of "permanent hardness," i.e., hardness due to the presence of sulphates and chlorides of calcium and magnesium, can be reduced by adding washing soda. The quantity of lime or soda necessary to soften a particular water depends on the degrees of hardness of the water, and this can be determined by forwarding samples to the Health Department for analysis. A highly satisfactory method of softening "hard" water is to pass it through broken zeolite minerals. This is the so-called "permutit" process, and many water softeners of this nature are procurable from hardware merchants. When the material becomes inert it can be revived by immersion in a brine solution for 24 hours. Thus the first cost is almost the only cost.

### Action of Water on Metals

Some waters have solvent action on lead. Acid water from peat swamps, waters well oxygenated, and those containing much dissolved carbon dioxide, chlorides, sulphates and nitrates, and those with much organic matter, are all capable of dissolving lead. When these waters are used, lead pipes should be avoided. The effects of lead poisoning are cumulative so that where water with only a slight trace of dissolved lead is habitually consumed, symptoms of lead poisoning may occur. Permanent hard water tends to attack lead while temporary hard water forms a coating on lead and prevents further action. Water containing traces of nitrates will dissolve the zinc in galvanised pipes, but zinc is not a cumulative poison. Galvanised iron pipes in preference to lead pipes are wisely employed in most parts of New Zealand. "Soft" water, and waters which contain much oxygen or carbon dioxide, have a corrosive action on iron and cause corrosion of pipes and tanks, and this corrosion is unavoidable.

### Storage of Water

For small quantities of water, tanks of various sizes are used. These may be of iron or concrete. For dairy purposes the site of the tank is important because the water is needed for cooling milk or cream, and where an iron tank is exposed to the hot sun the water in it becomes warm during the day and is practically useless as a cooling agent. Water keeps cooler in tanks made of concrete. The tanks are usually high to supply pressure, but every effort should be made to erect them in a site protected from the summer sun. Where an elevated tank is employed, water should be pumped up to it through the milk cooler. Better cooling is obtained in this way than when warm water gravitates from the tank to the cooler. Water may be pumped into a welded steel tank until a working pressure of 50lb per square inch is obtained. It is then unnecessary to erect a tankstand, or to have the tank exposed to the sun. Storage tanks should be emptied occasionally when conditions allow, to prevent the water in them becoming stale, and they may need cleaning out at intervals. Where green slime develops in storage tanks, bluestone at the rate of 1 part to 1,000,000 parts of water (1oz to 6000 gallons) will keep it free from the slime.

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Christchurch Press Co. Ltd., Printers