

plough up the subsoil to mix with the soil. The fertility of the soil also depends on its porosity."

## ii.

The several particulars in the character of a soil, by which its fertility is determined, are—the percentage of clay which it contains, the nature of its subsoil, the aspect of the land, its percentage of organic matter, whether it be drained or not, and the amount of available plant food it contains. If the soil is deficient in its percentage of clay, the farmer may occasionally cart clay on the soil, or, if the quantity of clay be too high, he may cart sand. If the soil has a gravelly subsoil, the farmer would improve it most by not ploughing deeply, so as not to stir it, and so produce a subsoil that would retain water. As to percentage of organic matter, if the soil is of a peaty nature, the application of lime, by destroying its acid, makes it into plant food: while, on the other hand, if it be deficient in organic matter, by the application of humus or compost, the fertility is improved. If a land be allowed to remain in a cold condition, owing to stagnant water, the fertility of that land is improved by drainage, and raising the temperature of the soil by admitting warm air and exposing the soil to the action of the atmosphere. The farmer can annually improve the available plant food in the soil by ploughing, harrowing, grubbing, autumn cultivation, and by fertilisers and manures, the ploughing, harrowing, and grubbing exposing the land to the air, so as to make up from it, in the absorption of gases, what has been taken away by the preceding crop, and by applying fertilisers and manures to raise the percentage of soluble plant food.

## iii.

The fertility of a soil is determined by—(1) the kind of substances in the soil, its chemical constituents; (2) by the state in which those constituents exist in the soil, viz., whether they are soluble or insoluble; (3) by the mechanical condition of the soil; (4) by the state of the soil in regard to the quantity of water it contains, and, after rain, whether it will allow this rain to pass quickly through it; (5) whether the soil be drained or not. These particulars are those by which we determine the character of a soil with regard to its fertility. To maintain the above all good, the farmer (1) manures the land with farmyard manure, and in certain cases with artificial and special manures to maintain in sufficient supply all the necessary constituents for plant-growth. (2.) He thoroughly cultivates the land, ploughing, scuffling, steam-cultivating, especially in the autumn, so that by exposing the land thoroughly to the action of the atmospheric agents, the

insoluble constituents may take a soluble form. (3.) He goes in for cultivation, for subsoil and trench-ploughing, for clay-burning, for paring and burning, for liming and mixing soils, all the above does the farmer do in certain cases to improve the soil both chemically and physically. The farmer also thoroughly drains his land, as, unless land is drained either naturally or artificially, no cultivated plant will thrive well in it.

## iv.

(1) A soil should contain every substance which the plant needs: (2) it should contain these substances in such a form that the plant may be able to make use of them: (3) it should be able to absorb moisture readily. The various tillage operations are all undertaken for the purpose of increasing or maintaining the standard of fertilisation. Thus ploughing, harrowing, clod-breaking, and similar operations, all open out and break up the soil, continually bringing fresh parts of it to the surface, to be acted on by the sun and air and water. These various influences all bring these substances which the plant requires into a more convenient form. Then the land is regularly manured to supply those materials which the plants have exhausted the land of. As to the third particular, drainage is the means by which the land is brought into a fit condition for water to easily pass through it, for stagnant water does great damage to the land—first, it makes it colder, for the heat which ought to be expended on the land is used up in evaporating the stagnant water.

We will now give imperfect answers to another question, which ought to have brought out a series of good replies, for it covers a very important bit of the theory and practice of agriculture.

QUESTION:—Why should the air of a dairy be clean and cool and dry? and what means are generally adopted for keeping it clean and cool and dry?

## i.

Milk being a very delicate and easily-tainted substance, if the air were in any way foul, the milk would very readily take up this foulness, and render the butter or cheese rank and unwholesome. The cleanliness of the air can be taken care of by having all utensils and the dairy itself clean; the cow, her stall, and the dairy-maid clean. Also that the dairy should be removed from all cess-pools, yards, and places whence the air might become fouled. It should be cool, because if too warm the milk will sooner become sour and unfit for butter-making and cheese-making. Also in summer the milk must be below a certain point of

coldness in order to be in a right state for the butter to be made. This coldness can be kept regular by either having the dairy below the surface of the ground or by having some tree to throw its shade on it all the day to protect the dairy from the glare of the sun. It should be dry, because if the air were wet the moisture would not let the cream rise on the milk so readily as in a dry atmosphere. The air can be kept dry by freeing the dairy from all superfluous water, that is, not letting the floor be all wet and sloppy. The dairy must be clean, but there is no need for the floor to be all in pools of water. Coolness can be made by having the floor of the dairy of stones or bricks, not of wood.

## ii.

The air of a dairy should be clean, because butter and milk are very delicate things, and are easily contaminated; and, if the air of the dairy were unclean, they would become spoilt, and so unfit for use. The air of a dairy may be kept clean by keeping the dairy itself and everything in it clean. The dairy-maid must be of cleanly habits, and, chiefly, the dairy should not be built anywhere near the dung-yard or manure of any kind that can in any way render the air in its proximity impure. The dairy should be cool because if it becomes too warm the milk turns sour, and so is not fit for use. Cheese raised beyond a certain temperature while it is being made, goes bad, and on that account the dairy must be kept cool. Cream also turns sour very quickly in a hot temperature. The dairy may be kept cool by having it built with a northern aspect, always having pure currents of air circulating in it, and keeping no fires or anything hot near it.

## iii.

Milk is a substance which is always ready for receiving and developing germs of decay which may be present in the air of a dairy. Hence the vital importance of cleanliness. For a good and efficient system of ventilation, under proper control, the cold air should be admitted to the floor of the dairy, on the floor line only; a funnel or pipe should be fixed in the centre of the roof, to allow the heated air to escape. An asphalted floor, slightly sloping, is best for purposes of cleanliness, and partly furnished with an outlet pipe to carry off the water. A good water supply is essential, to be used for either raising or lowering the temperature. When milk is set to cream, and exposed to foul or warm air, decomposition of a part of the albuminoids and fats takes place, lactic acid will be produced, and the milk will curdle; cream from this is mixed with curds and other strong products, and the quality of the butter is deteriorated.