

vegetables. If fruit trees are planted, plant them on one side of the garden, where they will not take the moisture that is needed for the small fruits and vegetables. Next will come the grapes, blackberries, currants, gooseberries, raspberries and strawberries. We will suppose that the vegetables occupy the other half of the garden, and thus we have a general plan for a kitchen garden.

The question of fertilizers is one that will depend largely on what is the most available. If stable manure is obtainable, I would use it for growing the most of the crops, but for some of the vegetables it should be well rotted before using it, and this means that one must do some planning to have a supply ready for use when wanted. If the supply of stable manure should be insufficient for the garden, I would use it for most of the vegetables, and commercial fertilizers for the fruits.

The seeds should be ordered early, or in good time for the hotbed, if one is made. It will pay you to have the best tools, such as are made by reliable makers and leading firms, and to have at hand ready for use, garden rake, spade and spading fork, hoes with narrow and wide blades, marker, roller, line and dibbles. Before you commence to plant the garden, make a diagram of it on paper, and locate the place for each crop, then, with the plan before you, you are ready to go to work.

Manures and Manuring

By T. C. Wallace, before the Ontario Farmers' Institute

(Continued from April 11th)

THE ACTION OF WATER.

The important action of water in manuring does not receive the attention it warrants.

I refer particularly to the soil waters termed as capillary and gravity in their action. That film which surrounds and clings to each particle of soil, or like a casing along the roots and hairs of plants in the soil forms a vehicle for the solution of plant food, and for carrying sustenance to the plant, has been explained before. To understand what is meant by capillary water one has but to observe the action of water rising from the saucer of a flower pot up through and saturating the dry packed earth. Capillaries are then tubes or chimneys which form in the soil, and up which the water climbs to the surface. If these are not broken by cultivation, during dry weather the water is rapidly evaporated and carried away by the winds. This loss of moisture by capillarity and evaporation can also be observed with the same simple apparatus, by weighing the water supplied from time to time to the saucer. The original weight of the dry soil in the pot being, of course, first obtained, a final weighing of the soil presents a very simple calculation.

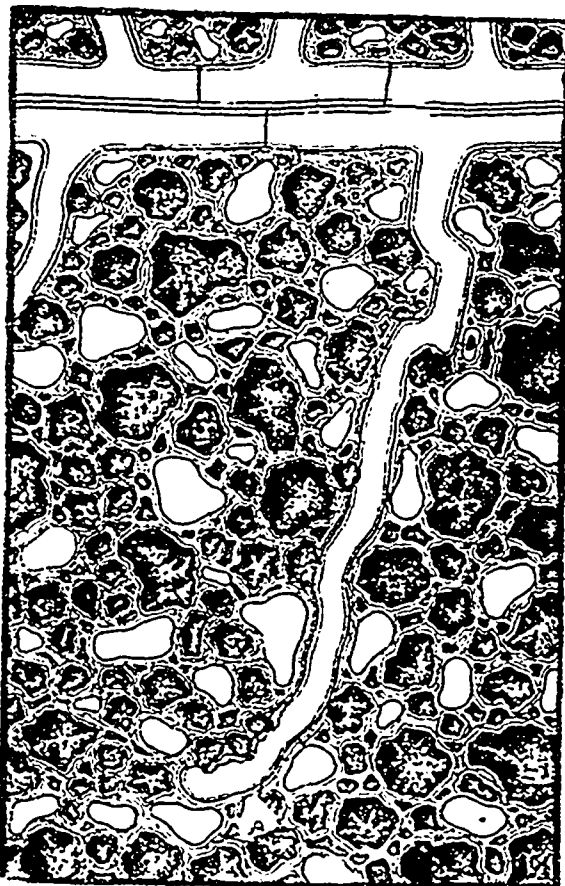
When we consider that crops use from 300 to 1000 tons of water per acre per season (and often even more), and that it takes about an inch of water all over an acre to make 100 tons, the loss of water brought to the surface by capillarity and blown away by the winds is a serious matter, which no amount of applied manure can compensate for. This shows us quite clearly the necessity and advantage of frequent surface cultivation, by which means the capillary chimneys are broken and a sort of mulch is formed for a few inches at the surface. But it is to

THE GRAVITY WATER

I wish to draw special attention. I mean the heavy amount of water formed in the soils by fall, winter and early spring rains and melting snows. So abundantly does this accumulate that the soils are at times practically afloat in it. It freezes up pretty solidly in the winter, and in the spring, when the weather becomes milder, the swelled land bursts apart by the action of the frost. The loosened particles of material become active in the soil, and by a sort of polarity or attraction, which takes place among them,

new combinations are formed. Particles of decomposed or decomposing manures and chemicals form combinations with soil particles, and thus the foundation of plant food for the coming season's crops is formed. If then we put off our applications of manures until after the gravity water has drained off we lose much of the benefit sought to be obtained by manuring. There is no machine of man's invention which does this distributing work for us so well as the natural method described.

If you examine the dung of the animals by throwing some of it into a tub of water and stirring it up you will notice how finely most of it is subdivided. It will then be easily worked into the soil by the action of water I have described if placed on the fall ploughed land while the gravity water is still plentiful and the heavy rains assist in washing it in. While it may be suspended in solution it does not immediately become liquid and get washed away, but on the contrary forms combinations with other substances in the soil. For the same reason we observe surer and better action from phosphates, or other manuring materials reduced to a very fine powder. In understanding these things we appreciate more fully the deductions of eminent scientific agriculturists like Wagner, Maercker and others who emphasize the necessity of reducing manurial materials by fine grinding. It is true that in doing this we are but



Diagrammatic representation of the relations of the root-hair to air and water in the soil. The angular bodies are earth particles, sheathed with a surface-film of water. The root-hair descending from the root has a similar water film upon it. Larger portions of water fill in the intersutial angles. The numerous black spaces, similarly film encircled, are portions of air distributed among the mass.—From Sacks.

simulating nature, which gradually reduces straw, clover and other organic substances to fine humus powder. But this action is slow and in the struggle which competition in this age forces upon us we must use methods to produce more rapid effects. One other point suggests itself and that is the

AIR IN THE SOIL.

A soil in proper mechanical condition should contain about one-sixth of its bulk of air, for plants take their oxygen through their roots. This is a matter which is left almost entirely to chance. The pressure of the air on the soil is only about 14 pounds, and as the gases formed by decom-