

the seed and which is the means of conveying food to the plant rootlets; for the performance of these important functions, it is obvious that it should possess no injurious properties. Experiment has demonstrated that the effect of a solution such as we find in alkali soils on the cells in the tissues of the roots is to extract or withdraw from them by a process known as osmosis their natural water. As a result the cells lose their turgidity, their protoplasmic contents shrink from the cell wall, the plant wilts and death may ensue. The higher the percentage of alkali—in other words, the more concentrated the solution—the more severe the effect in this direction.

Again, there can be little doubt that many of these alkali salts, after absorption by the plant, act as true poisons on the life of the vegetable cell.

As already remarked, 'black' alkali is more violent in its action than 'white' alkali, and consequently is much more to be feared. The sodium carbonate it contains is directly corrosive, cutting into and eating away the tissues, especially at the immediate surface of the soil. Very small quantities in a soil are sufficient to prevent seed germination or to destroy the tender rootlets of the seedling, if the young plant appears. It is also more injurious than white alkali to fruit trees, corroding the tissues of their bark at the surface of the soil, i.e., at the crown of the root. Signs of this girdling are to be observed in the leaves turning yellow and dropping prematurely—such indications are usually the precursor to an early death.*

While speaking of the effect of black alkali on the plant, a word may be added respecting its action on the physical condition of the soil. All kinds of alkali have a tendency to injure a soil's tilth but this is particularly marked in the case of black alkali. The soil readily puddles, flocculation, or the property of forming flakes, is destroyed and the land becomes in a large degree impervious to water. On drying, hard refractory masses are formed and the soil is extremely difficult to work. Very frequently a hard, practically impenetrable hard-pan forms under such soils, making it almost impossible to put in a system of tile sub-drainage.

RECLAMATION OF ALKALI SOILS.

By leaching and under-draining.—Since, as has been shown, the formation or occurrence of alkali is due to an insufficient rainfall, it naturally follows that thoroughly washing the soil should prove an effective means of getting rid of the injurious soluble salts. It forms, indeed, of all remedial measures the one that gives the most satisfactory and permanent results. Alkali lands for the most part occur in regions where provision is made for supplying the crops' needs with water by irrigation. This water can be used to wash out and carry away the alkali. However, if the natural drainage of the soil is not good, flooding by irrigation should be preceded by the construction of an adequate system of under-drainage. Irrigation of lands at all heavily charged with alkali and underlaid by a hard-pan, without under-drainage, makes matters worse. Flooding may furnish temporary relief by washing the alkali below the zone occupied by the roots of the crop at the beginning of the season, but as the water evaporates (it cannot escape by drainage) alkali is again brought to the surface by capillarity. If the water has penetrated layers of soil containing much alkali then the surface soil will, as the result of this evaporation, be worse than before the flooding, for it will now be impregnated with salts that were previously distributed through probably 3 to 5 feet of soil. This is known as 'rise of alkali,' a direct result

*The symptoms of suffering from black alkali are very similar to those produced by too high a water table. The writer examined several orchards on low lying areas in British Columbia in which the trees were dying, supposedly from black alkali, but which were found to be planted on a soil practically free from alkali but in which the water stood within a few inches of the surface for weeks together at certain seasons of the year. It is well, therefore, if the trees show injury, to examine into the matter, bearing this in view. Drainage is essential, and if not naturally good, it must be provided, whether alkali is present or not. Further, if carbonate of soda is suspected, even in traces, land plaster should be sprinkled around the base of the trees and quite close to the trunk, to prevent corrosion of the tissues. It will be found an excellent preventive against injury from black alkali.