

done is to prevent the loss of soil by the effect of the washing of heavy rains, and to prevent this, I know of no better plan than surface drains, made with a plow, and subsequently cleaned out with the hoe, sufficiently near to each other to carry off all the surplus water of the soil; the water by these means being distributed in many channels, could no where collect in sufficient abundance to carry off the soil and make unsightly gullies. These drains should have but a slight fall, and end by conveying the water to a fence, woodland or some stream.

In these locations soils should be plowed deeply, as the deeper the soil the more room would the surplus water have to diffuse itself, and prevent injurious washing.

The benefits resulting from the above recommendations will be two fold, first, the direct saving of a large quantity of land, for when the whole mass of the soil is washed off, some years must elapse before the hard shaly subsoil becomes sufficiently disintegrated and decomposed to furnish a good foundation for crops; secondly, the retention of the finely divided particles of soil, that part which contributes directly to the nourishment of the plant, from being washed out by a large mass of water rapidly passing through it. Indeed, on all of this variety of soils we must recommend deep plowing, and on the stiff heavy parts of it, the turning in of green clover crops. *With regard to the nutrient manures necessary to meet its deficiencies, I can best advise that phosphate of lime, whether in the form of Columbian guano, Mexican guano or bone dust, be but sparingly applied, and that only on soils that have been a long time in cultivation and not well manured.* Where these soils are deep and have been well improved, the use of stable manure preserved as I have directed, with the addition of one hundred pounds of good Peruvian guano to the wheat crop, will supply an abundance of phosphoric acid to soils that have been well improved, with a deep soil, that is, one where the rocks or shales do not come near to the surface, for a full rotation. On these latter soils phosphoric acid in some form is necessary, because they do not contain it in sufficient abundance to meet the wants of a large crop. This defect can be readily explained. The phosphate of lime, whose valuable constituent is phosphoric acid, is liable to continual depreciation in soils from two causes: first, removal by crops; secondly, its removal by the rain water, which dissolves and carries it off; its supply is afforded by two ways, first, its direct supply by means of manures containing this substance, and secondly, its deposition in the soil in being brought up from the subsoil during droughts in the manner which I have explained on page 56 of this Report. On soils which