

# ESSAY ON DRAINAGE,

BY

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In whatever state the *land* may be found in any country or locality, man must endeavour to render it more fertile by draining and cultivation.

According to the latest discoveries, known in remote times practically, although not explained then theoretically, the objects of *drainage* are threefold :—1st. To remove the superabundant, stagnant water, deprived of those gases which are necessary for fertilization :—2nd. To admit atmospheric air into the pores of the earth, which have been filled with useless and noxious moisture :—and 3rd. To render the land warmer, by making it more accessible to the operation of the air and the sun ; without which, no vegetable can freely develop its germ and produce fruit.

By far, the greatest number of Farmers understood then, as they understand now, the process of draining their arable *land* and *meadows*, by ditches and furrows, as the only means of removing from the Earth's surface the superabundant water, or moisture—but the admission of the atmospheric air and warmth to the root of the plant, very rarely attracted their attention. They did not consider, even, why ploughing and manuring the land were necessary, being satisfied with the fact, that uncultivated land produces no crop, particularly that of corn.

The pulverization of the earth, by means of a plough and harrow, is in itself nothing else, but a separation or

division of the particles of earth at such a distance from each other, that they may easily feed the germ, and allow the sun, by warming it with its rays, to develop that germ into a plant.

When the land is too loose, as for instance, in bog or sand; or too close, as in clay or marl,—vegetation is not easily obtained; for this reason, among others, that in the first case, the particles are too distant, and in the second, they are too close each other.

The same phenomenon may be easily explained by observing, that fishes and mummies, exposed to the action of the air in the shade, become dry, and may be preserved for a length of time;—similarly, fish and meat, put into a tin case, closely stopped, after all air and moisture become evaporated, may be preserved so long, as the case, being in a sound condition, will not allow the air to enter. The first instance will apply to loose land, the second to that which is close.

But when the bog or sand is mixed with clay or marl, or vice versa; when we add to that a certain proportion of chalk or lime; and when, by that admixture we have produced the necessary adhesion in the heterogeneous particles; the land so prepared, will change its color, in proportion to the preponderating element, and will be rendered fertile,\* although the clay alone is supposed to contain the *humus*, or generating property, while the other mixtures contain none, but serve only as medium to a desirable cohesion, *i.e.*, keeping them neither too close, nor too loose. On such a foundation, manure will remain long, with good effect, and in time, the surface will assume the appearance of

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\* This remark is very just; I have seen land, after drainage, change its hue from white to red.—*Josiah Parkes, C. E.*

loam—for that, which we generally denominate “*Loam*,” is nothing but a mixture of clays, sands, rocks and stones, broken by the influence of the sun and frost, washed by rains and thawed by snow, combined with vegetable particles, and deposited below on a certain surface, upon the nature of which depends its fertility.

The prosperity of a farmer, undoubtedly, depends on his knowledge of the sort of strata, which is below the surface of his land ; but as that matter, strictly speaking, belongs to *Geology*, we will leave it, and endeavour to solve the problem : *Why, and how does drained land become warmer ?*

“The presence of too much water in the soil,” says Professor Johnson, (Chem. p. 109,) “keeps it constantly cold. The heat from the sun’s rays, intended by nature to warm the land, is expended in evaporating the water from its surface, and thus the plants never experience that genial warmth about their roots which so much favors their growth.”\*

Whoever has observed the falling dew in the evening, and its disappearance in the morning ; whoever, by necessity, or otherwise, has spent the whole night in a field, with no shelter above his head, can tell how cold is the morning of a fine day ! Indeed, to remain motionless at early dawn would be seriously felt—motion is necessary to produce even a moderate degree of warmth. But as the sun rises, the drops of dew, like alcohol in a retort, in the form of condensed pearls, hang on the grass and flowers, like crystalized salt on the branches of a tree.

The explanation of this phenomenon is : that the *Caloric*

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\* *Vide*, J. Parkes’ Essay.

contained in the above stated grass, flowers and dews, gradually escaping from them, joins its Father, the Sun, by the medium of his Messengers, the Rays ; and the forsaken dew-drops like the tears of an innocent Bride, reflect the brilliancy of that glittering Master, who dries everything he touches, and who comes in the morning to recal his child, the *Caloric*, left behind on the earth the last evening.

But before the Sun begins to warm the surface, its heat not being able at first to reach the ground itself, on account of the dew and moisture, screening the plants from the influence of this despotic Master, imbibe the *Caloric*, first on the brim, by the gentle operation of the *Capillary Rays*, both of which proceeding from the same source, join each other instinctively at the first recognition, as friends meeting on a distant land.

Now the Rays remove the moisture and suspend it during the day in the air, and having thus overcome the obstacle, they act freely on the plants by warming them till sunset.

But steadiness, in some degree, is foreign to the Physical world. The same Sun, although very beneficial to the plants, tires them in the course of a day, and they hang their heads in very weariness of his society. But when his duty is performed, and he retires from our orb, the soft and welcome dew, enriched with ammonia, descends with stealthy steps, and receives their whispered complaints of the endurance which they suffered during the day. The *Caloric*, concealed in the plants, joins the heavenly dew, and *the three friends meet again* ; their conversation, in sweet odours, is felt by those who now walk abroad—for aromatic is their language.

At length, the Sun returns, and expels from earth the sweet and gentle nurse, *the Dew*, whose tender caresses would but injure the plants, by preventing their arrival to maturity and fruit ; which, according to the law of nature, ought to be accomplished in a certain season, as after that, they must die, and leave their remains for the benefit of the vegetable and animal kingdoms.

When we walk on wet grass, why does the foot-print remain so long unaffaced ? The reason is this :—Our feet have disturbed the pearls of dew, and destroyed their globular forms ; by this process we prevented the action of the sun's rays, which being not of massive but capillary breath, incapable to concentrate themselves on a flat surface, require a longer time to collect the moisture again into globules, and to continue the operation which was interrupted by our walk.

What we say of the dew, is only a partial explanation of the process which the sun is obliged to perform for the purpose of removing the wet, and afterwards of heating and rearing the plant.

But this action takes place on the surface of the land, and affects only the stem—the germ of the plant is deeper in the earth, and if the moisture be too abundant there, it not only prevents the sun from warming and stimulating it, but makes it colder in proportion to the intensity of its own heat, as we ourselves experience while bathing in a river, either when the sun has full power, or at sunset. A thermometer dipped into water will rise higher in the day-time than in the evening—but the effect on our body is the contrary, and we readily decide, that the water was warmer after sunset than at mid-day, for the very reason,

that the temperature of our body was higher in the day than in the evening.

Man should, therefore, moderate the harmony between the sun and the plant, by removing, in a certain degree, the overplus of moisture from the ground, which cools the germ and the root, without supplying them with the necessary gases, of which in time, they would be deprived.

In India, and most Eastern countries, as well as in Italy, there is a custom of watering the floors and walls, during intense heat; and in some places, water is sprinkled outside the walls, which are sometimes covered with cloths, kept constantly moist. The interior of a house, thus secured, has an agreeable coolness, because the sun's rays, as long as they are employed in evaporating the moisture from the cloths, cannot penetrate the walls, and by their medium, raise the temperature inside.\*

We may find a happy illustration of this phenomenon, if we take an earthen filter, filled with water, covered with wet rags, and expose it to the action of the sun's rays. As long as the rag is kept wet, the water inside the filter will be cool, and in a few hours will be cooler than it was when taken from the well. But if the same filter, still enveloped in wet rags, be put in the shade, it will in the course of a certain time, give water the same temperature as the air, by which it may be surrounded.

Should any one doubt this, let him wrap himself in a wet flannel, and be exposed to the action of the sun's rays—in less than half an hour he will shiver with cold. But if taken into a house, and put into a bed, still wrapped in

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\* N.B.—The walls are positively cooled by the heat abstracted from them in converting the water on the cloths into vapour—steam.—*J. P.*

the wet flannel, he will soon find himself in a perspiration.

In the first case, the sun will extract the caloric from the wet flannel, and from the man's body—in the second, the water having stopped up the pores of the flannel, the animal heat will be accumulated around the body.

The plant, however, in its undecayed state, does not possess that animal heat. It requires the sun for the promotion of its life and growth—as from that luminary, light and warmth are obtained; it needs moisture filled with ammonia, and clay, to nourish it—as a tender infant requires the mother's bosom.

But as the sun, without moisture, will dry the seed, and burn it, so, the stagnant water, without gases, will chill, decay, and kill the plant. It may, in some cases, grow, and rapidly shoot up a stem, without the light and heat of the sun, but will wither before it comes to maturity. A seed deposited in dry sand, and exposed to the action of the sun, will never re-appear—but when a clever gardener places it in a hot-house and supplies a sufficient quantity of the said principle, moderating the light, heat, and moisture, according to the nature of the plant, it will grow healthy and flourishing, and will more rapidly come to perfection.

The gardener's field is but small—the farmer requires crops on a larger scale, for he must grow his corn and grass, in a less expensive manner; for him, therefore, it is necessary to know the principles above stated, to enable him to contrive means for the success of his undertaking. He must prepare the land according to the nature of the seeds, he intends to sow in it. God sends him light and warmth from the sun, and moisture from the rain and dew,

but in order to combine these advantages of light, heat and moisture, the farmer himself must so drain his land, as to secure proper nourishment to his grain, which will then produce an abundant crop. By so doing, he will take from the ground all superfluous moisture, and leave in it sufficient to prevent the land becoming too dry. He will allow sufficient dew and rain to sink into the earth to supply it with the gases, so necessary for the root; the stagnant water will descend, and the warm air entering the tubes, by its natural tendency to the surface, will warm its bed better than the sun, on the same principle as the *filter*, which, being placed in the shade, rendered the water warmer than when it was exposed to the sun.

We may, by the application of these means, use this expression, "*the land will be civilized*," as it will now yield such a crop as nothing but the civilization of man's mind could induce him to desire, and enable to promote; and he will have entirely changed its nature from that state of wilderness which is described by Job, when he says, "that it produces the rush and flag withering before any other herb."

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