otherwise gradually decrease. The agricultural value of an insular position becomes thus apparent. The rains wash out saline substances from the soil, but the winds from every quarter bring them back; and a green and luxuriant vegetation is kept up, where otherwise the ingredients of a fertile soil could only be brought together by the labour and industry of man. The fields of our sister isle owe something of their 'emerald green' to the winds and waters of the wide Atlantic.

To such practical results, far more numerous than our limits permit us even to notice, dip, and still does, the chemical examination of soils lead the enquiring agriculturist. But at this stage of his enquiries, another striking feature presented itself, the study of which led to further and more satisfactory, because more advanced, conclusions. It was seen that, on the same soil, the application of the same substance—for the sake of simplicity, suppose it a saline substance—promoted the growth of one crop and not of another. If clover and wheat, for example, grew on different parts of the same field, it was seen that gypsum or common salt would greatly increase the luxuriance of the one, while it caused little or no change in the appearance or produce of the other. Something, therefore, must depend upon the kind of plant which is grown upon it, as well as upon the chemical constitution of the soil itself. There must be some as yet unknown chemical relation between the crop to be grown, and the manure which could be beneficially applied to it. What was the nature of this relation? If discovered, might it not be brought to bear advantageously upon practice?

These new questions gave rise to new, refined, and tedious chemical investigations into the nature and composition of plants, and of their several parts. A new field was opened to the view, on which much labour has already been expended, from which much knowledge has been reaped, but by far the largest proportion of which is as yet wholly unexplored. We shall briefly glance at the points which may already be considered as in some degree established.

1. All plants, like all productive soils, consist of an organic or combustible, and an inorganic or incombustible, part. The difference, in this respect, between the plant and the soil is, that the latter contains only from three to ten parts, the former from ninety to ninety-eight parts of combustible matter.

2. That the incombustible part or ash of the plant contains a sensible quantity of from eight to eleven different substances—*these substances being the same exactly as are found in all fertile soils.*

3. That though these substances are all present in all our cultivated crops, yet that some of them are more abundant in some plants than in others—and in some parts of the same plant than in other parts. Thus in some vegetables, lime abounds; in others, magnesia; in others, potash, and so on; while in one part of a plant much silica, in another much bone earth may be uniformly present.

These points are not new. They were first put forward, but darkly, by Ruckert—were in some measure understood by De Saussure—were clearly brought out and enforced in the several German works of Sprengel: but were first presented in a captivating form to the British public in the work of Professor Liebig.

We do not specify here other less general and less intelligible results. From those which have been stated, much light is thrown upon practical points which were previously unintelligible. Thus, it no longer appears singular that all fertile soils should contain ten or eleven incombustible substances. These substances are constituent parts of all plants, without which they cannot exist or grow in a healthy manner; and the soils are fertile only because they are in a condition to give to the growing plant every thing it requires for the building up of its several parts. Again, a soil in which some of these materials are wanting or defective, is barren or poorly productive, because it cannot supply all the wants of the plant, or cannot do so with sufficient rapidity. The plant may be likened to the bricklayer, and the soil to the laqourer—without both mortar and bricks the wall cannot ascend; and unless they are supplied with sufficient quickness, the progress of the work will be necessarily retarded.

So it was explained also why a soil from which none of these substances was wholly absent would grow a plant A, while it refused to grow a plant B. Those different plants might demand lime, or magnesia, or potash, or phosphoric acid, in different proportions. A crop A, which required much potash to bring it to perfection, would not flourish in a soil because it abounded in lime; while a crop B, which demanded much lime, or phosphoric acid, would grow feebly and with slowness where these were scarce, however much soda or potash the soil might contain.

Thus it appeared further why in natural forests successive races of trees, broad and narrow leaved, succeed each other—why on the old pastures and prairies the grasses of one age die out, as races and families of men do, to be replaced for a time by other species as herbage—and why, in practical husbandry, a rotation of crops is most conducive both to the profit of the farmer, and to the permanent fertility of the land. Of those things of which one crop contains and requires much, another crop contains and therefore requires less. Thus, if we alternate the kind of plants we raise, we shall exhaust the whole soil equably; but continue one kind of crop too long, and the land becomes *sick* of it—that is, it cannot supply with sufficient rapidity or abundance those substances which this crop especially requires.

And now the true action of those saline substances, hitherto called stimulants, became more clearly manifest. They no longer appeared to act like wine upon the human body, exciting it to an abnormal or unnatural effort, which was afterwards necessarily succeeded by languor, feebleness, and depression. They were acknowledged really to feed the plant; since they supplied those things out of which its several parts were built up, and without which they could not be satisfactorily completed. And if the soil was less productive in after years, in consequence of the application of these substances, it was because the crop had extracted from the soil more than the manure had given to it. The so-called stimulant supplied potash, or soda, or lime only to the soil, and, getting these readily, the plant grew rapidly; but it gathered out of the soil, at the same time, magnesia, and sulphur, and phosphorus, without which it could not grow. The large crops which were carried off exhausted the soil, therefore, of these latter substances; and unless these were added again in some form or other, the soil must remain impoverished, and more or less unproductive. If the builder have abundance of stone or bricks, and we give him mortar in addition, his walls and houses will rise rapidly; but the faster they rise, the sooner will his bricks be exhausted; and when this happens, we shall look in vain for an advance in his work, if we continue to supply him with mortar only. Give him a new supply of bricks, however, and he will start afresh. So it is with the soil. The so-called stimulants excite the plants after the same manner as the mortar excites the builder—leave behind a languor or exhaustion of a similar description, to be removed, also, after a similar manner.

Further, it appears that plants must of necessity obtain these saline substances if we desire them to grow; that we must therefore add them to the soil, unless nature kindly interposes in our behalf, and, by some of her happy contrivances, repairs the constant exhaustion. We must also add those particular substances in which our soils are specially deficient—which the crop we wish to raise especially requires to bring it to perfection—or of which the liquid manure we have so long allowed to run to waste, has especially robbed the land.

And here Geology again comes in, at once receiving and giving light in reference to this important branch of agricultural investigation. We have already seen how the geological map tells us of the general characters and composition of soils over large areas—when they rest upon or are derived from rocks of the same, kind, or of the same age. This information it gives us, because of certain chemical analyses previously made of the soils and rocks of the different geological formations. But Botanists had often remarked, that besides the marked influence of climate on the growth and dispersion of the vegetable races, the investigation of which had given rise to interesting treatises on the *Geographical distribution of plants*, other circumstances also materially affected their choice of a site, or place of growth. It was seen that the *habitat* of a plant depended upon the general character of the soil, as well as upon the general nature of the climate. Whole geological formations were characterized by the luxuriant growth of certain races of plants; while, even in climates known to be favourable to them, other races of plants refuse to flourish on the soils by which these formations were covered. Hence arose the enquiry as to the *Geological distribution of plants*. But the reason of this peculiar distribution became apparent, when it was shown, on the one hand, that each race or order of plants had special wants which the soil alone could supply; and, on the other, that each geological formation was covered with a soil more or less special in composition, which could supply one or more of the substances required by plants in larger quantity than it could supply the rest. Hence the seeds of plants, wafted every