It is evident that this portion of the inquiry can only be set at rest by an application to chemistry. It is chemistry alone which can furnish us with a clear idea of the composition either of the soil or of the manure with which we seek to operate upon that soil. I might mention many instances in support of this position, but I will content myself with one—that of a farmer in whose *soil there is a large quantity* of phosphoric acid present in a form of combination in which we meet with it in bone-earth, or as earthy or alkaline phosphates. When he tries the effect of ammonia for its salts, and applies a top-dressing of sulphate of ammonia, he finds a greatly increased crop—a greater quantity of grass than would otherwise have been produced. Another farmer, whose soil is entirely destitute of phosphoric acid, tries the same experiment, and finds perhaps no benefit at all from the application of ammoniacal salt—for instance, sulphate of ammonia derived from gas liquor. What is the explanation of this? The art of agriculture itself can give us no explanation whatever. Both may be clayey, or gravelly, or sandy soils, and yet this difference of result obtained. A difference in point of mechanical structure has no influence whatever in this matter; it does not in the least explain the difference in result obtained by the application of this sulphate of ammonia. We find, however, on reference to the chemical constituents of grass, that those constituents which afford nutriment to the cattle feeding upon it must contain, as one of their essential ingredients, phosphorus. This phosphorus cannot be *manufactured by the* plant itself; it cannot be manufactured by any process in the soil; it must be present in the soil, or it cannot be conveyed into the pores of the plant and converted into the nutritive constituents which it is our object to form in the cultivation of plants. The consequence is, that the nitrogen contained in these nutritive constituents—this nitrogen which we wish to supply in the sulphate of ammonia, although an essential constituent of the nutritive matters referred to, is of no use whatever as supplied in the sulphate of ammonia, unless phosphoric acid be present in the soil. This is one of the many instances which we might adduce as showing the advantage of combining science with practice in ordinary farming operations.

Another advantage is, that by the aid of science we are enabled to economize our manures and apply to our fields just the kind of ingredients which they require. Take, for example, the case of a farmer who has land, perhaps, rich in nitrogenous constituents, and with a deficiency of phosphoric acid in the soil. Now if, by the advice of a neighbour or other person, he uses sulphate of ammonia or other ammoniacal salts which may be in the market, he throws away just as much money as he pays for the salts in question. If, however, he knew that his land did not require *these ammoniacal salts* but was in want of other constituents, such as phosphoric acid, then he would use bone-dust or guano, both of which contain these phosphates in large quantities, and would therefore supply *the deficiency. Another advantage flowing* from the connexion of science with agriculture is, that we are enabled to ascertain by these means what kind of crops will produce the greatest amount of nutritive and fat-forming matter from a given surface of land. It is evident this question can only be set at rest by an application to chemistry. We must ascertain, in the first place, what ingredients it is necessary that we should give to our stock in order to fatten and bring them to their full growth. We find two distinct classes of substances requisite for effecting this object—namely, substances rich in nitrogen for the formation of muscles, and another class of compounds for laying on a superstratum of fat, which is now such a great desideratum in the feeding of cattle. The first class of substances which it is requisite to produce in the food we give to animals consists of those containing a large amount of nitrogen and phosphoric acid; the second class, for the production of fat, consists of *substances which may* be entirely void of those two elements, nitrogen and phosphorus. If we wish simply to fatten cattle upon our land, we know, by reference to chemical science, that we must endeavour to *produce as much combination of carbon and* hydrogen, in the form of sugar, starch, &c., as we can; and we need not particularly trouble ourselves about producing large quantities of flesh-forming principles, since the animals we seek to fatten are usually in a full-grown state. But in rearing your animals, we must look to muscle-forming principles, and give a sufficient quantity of phosphates to enable them to form a due proportion of bone.

Another advantage which agriculture has already derived from the science of chemistry is this, that chemistry has shown us from what sources plants derive their constituent elements. Formerly, farmers imagined that the richer the land was in humus, or humic acid, the larger the crops it produced. They imagined that these carbonaceous substances were dissolved in the rain water which descended, or were in some other way conveyed to the roots of the plants, and administered to the nourishment of those plants just in the manner that soup operates in feeding man. This was the mistake: the comparison of the life of plants with the life of animals—two states of existence which are precisely opposite to each other. The function