MARL.

A LETTER ADDRESSED

TO

THE AGRICULTURAL SOCIETY

OF

JEFFERSON COUNTY, GEORGIA.

BY J. H. HAMMOND.

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SILVER BLUFF, SO. CA.,
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Dear Sir,—

I embrace the earliest opportunity my other engagements have allowed me, of fulfilling my promise to comply with the request of your Society, to give them such information as I possess in regard to Marl. I am happy to learn that an interest in this matter has been excited in your County, and if in what I am about to say, I shall fail to meet all the inquiries which might be made, it will afford me great pleasure to communicate more fully on particular points, at any time hereafter.

Aware of the strong prejudice existing too generally among Farmers against every thing *new* in farming, it may not be amiss for me to begin by saying, that however new to us Marling may have been a few years ago, it is in point of fact one of the very oldest agricultural operations of which we have any authentic record. Pliny, who wrote during the first century of our Era, mentions Marl as having been long in use among the Greeks and also in Gaul and Brittain. He describes pretty accurately the appearance of all, or nearly all, the kinds of marl now known. He even specifies the peculiar effects of each on soils, and states the length of time these effects were supposed to last, which was from 10 to 80 years, according to the quality of the marl and the land marled. Varro, who wrote a century before Pliny, mentions having seen fields in Gaul covered with a "white fossil clay," and also describes several varieties of marl as in common use.

Although these writers, because ignorant of the discoveries of modern science, made great blunders in attempting to account for the extraordinary influence exerted by this earth on vegetation, and to discriminate between its varieties, still it is unquestionable that the "*leucargillon*" of the Greeks, the "*fossicia creta*" of Varro and the "*marga*" of Pliny, were no other than the same kinds of marl we find here, and which at this day so many enterprising farmers, both in Europe and America, are actively and extensively engaged in spreading over their fields, and which have been continuously used for that purpose more or less from the remotest ages. Marling, then, is certainly no novelty—no untried experiment, that can for a moment be classed among modern humbugs.

There is no question, however, that the want of chemical knowledge has in time past led to great errors in its application and consequent failures—often to serious injury from its use. When the element in marl which gives it its chief virtue, and also its certain and its probable chemical action on the soil and its growth, were all unknown, every new application of it was to some extent an experiment which might or might not succeed. It is a great proof of its universal value, that so many succeeded as to maintain its reputation and consequent use. Mr. Ruffin of Virginia, was the first in this country to explain on scientific principles the true nature of marl, its mode of action, and the proper manner of applying it, and to carry his theory through the ordeal of successful experiment. He is the founder of the marling system among us, for which he will be long and deservedly ranked among public benefactors. His

"Essay on Calcareous Manure" contains every thing that it is important to know about marl and marling. Throughout my operations, it has been my guide, and it is still, I believe, far in advance of any thing that has yet been published in any country, on the subject. If I thought every member of your Society would procure a copy of that Essay, and peruse it carefully, I might close my letter here, by earnestly recommending them to do so. It is with the hope of inducing some of them to do it, as well as to testify my respect for them, by responding to their inquiry, that I proceed.

Marl, as correctly defined by Mr. Ruffin, and now known in this country, is Calcareous Earth: that is, earth containing lime. The lime found in it is united for the most part with carbonic acid, and is therefore called carbonate of lime. It sometimes contains lime in other combinations, as sulphate and phosphate of lime. Azote, has been found in marl also, and magnesia is not uncommon. Besides these, it contains sand and clay in various proportions, and occasionally a green sand highly prized as a manure on account of its being rich in potash. All of these constituents are valuable to the farmer. But it is the quantity of carbonate of lime in it which gives its character to Marl, and by which it is estimated when it is called rich or poor.

Nothing is more deceptive in appearance, and the most experienced are liable to great mistakes, if they attempt to estimate its value by the eye, and without employing the proper chemical test. There is a rock found in abundance in your county, and which is of great value for other purposes, that has deceived many. It seems to be a mass of shells; but the fact is, they are only effigies, or casts from which every particle of lime has been long since washed away, and sand deposited in its place. There is also a fine, soapy earth, usually of a pale ash colour, though sometimes darker, that many have regarded as very rich marl. This is what was formerly, and by foreign writers is still, denominated clay marl. It seldom contains much lime, and is generally wholly destitute of it even when found in marl beds. This soapy feeling is a very uncertain indication of lime. Where it is observed in marl, it is usually owing to something else, chiefly to magnesia or alumina. A marl is found whiter and harder than the earth to which I refer, but of the same lamellated structure and a somewhat soapy touch, that is exceedingly rich in lime,—that at Shell Bluff containing 90 odd per cent. of the carbonate. It yields readily to the knife, crumbles when exposed to a severe freeze, and is altogether the most valuable marl we have. Unfortunately, it is not met with in large quantities in our formation. In our marl beds immense quantities of large shells are generally found. Inexperienced marlers have been known to spread these on their land. But they are of little or no value, unless burned or crushed. They were deposited where they are found before the human race inhabited the earth, and being for the most part sound yet, will yield little or no lime to the soil in our day. Even the masses of much smaller, conglomerated shells, though very rich in lime, are not among the most valuable marls, unless broken up and pulverised to a considerable extent. There is a marl abounding with us, which to the naked eye seems to be mere sand, that is much more valuable, though it does not contain two-thirds of the quantity of carbonate of lime: it mixes at once with the soil and exerts its full influence in a comparatively short period. The most valuable marl, practically speaking, that is found in any quantity at Shell Bluff—and will be found in your marl-beds, for the formation is the same—is composed of very fine shells, scarcely discernable, which are loosely cemented together and readily fall apart. It is of different colors; mostly white, sometimes purplish, yellow, or light brown. The most abundant marl found in our formation is hard and compact, of a grey color, containing 50 to 60 per cent. of lime, and crumbles on exposure to the seasons and in handling.

But, as I have said, the value of marl cannot be estimated by its appearance. Between earth which contains 75 per cent. of carb. of lime, and that containing 20 per cent., or even none at all, the most experienced are far oftener than otherwise unable to distinguish without using the proper tests. These are so readily to be procured, and in fact the analysis of marl, so far as to ascertain the quantity of carbonate of lime, is so very simple an operation, that the marler should leave nothing to conjecture on this important point. Earth containing any notable proportion of carbonate of lime, will effervesce if thrown into vinegar or almost any acid. But the best test is muriatic acid: a single drop of it will produce immediate effervescence whenever there is carbonate of lime. To discover the precise quantity of carbonate of lime in any marl, it is only necessary to have this acid, a pair of common apothecaries' scales with weights, and a wide mouthed vial. Dry the marl thoroughly on a shovel, over the fire, and pound it in a mortar, to a fine powder. Fill the vial about one-third with the muriatic acid diluted with two parts of water to one of acid, and balance it exactly in the scales, with weights of any kind. Then add, very slowly, 100 grains of the powder previously weighed, taking care not to make it effervesce so rapidly as to throw any of it out of the vial. When the effervescence has completely ceased, blow gently into the mouth of the vial, with a common bellows, to expel any of the carbonic acid gas which may have remained in it in consequence of its being heavier than the atmospheric air. Weights to the amount of 100 grains must now be put in the opposite scale to balance the 100 grains of powdered marl put into the vial. It will be found that in consequence of the escape of carbonic acid in a gaseous form, the scale with the vial will rise: put weights into it then until the scales are once more exactly balanced—the number of grains put in the scale with the vial will of course indicate the weight of the carbonic acid that has escaped. Now carbonate of lime contains in 100 parts very nearly 56 parts of lime and 44 of carb. acid. If then 44 grains have escaped in your analysis, the specimen is pure carbonate of lime. If only 22 grains have escaped, then it contains but 50 per cent. of carbonate of lime. And so in proportion to any quantity of carbonic acid which may have been expelled. In practice, it will be found most convenient to use 50 grains of the powdered marl. A very few trials will enable the most inexperienced farmer to ascertain in half an hour with sufficient precision, the value of his marl. That value depending mainly, as stated, on the quantity of carbonate lime which it contains.

The value of lime for agricultural purposes, is not only established by the experience of all ages, and so far as we know, of all countries, but must be obvious, when it is known that chemical analysis has detected it as a constituent of every vegetable that grows on the surface of the earth. It is also the chief element of the bones of every animal—even of those that feed on grass only. It is therefore not only beneficial, but indispensable to the growth of all kind of vegetation. The All-Bountiful Creator has diffused it over the whole globe, as extensively as almost any known substance. But like all His gifts, it has been, for wise and good purposes, no doubt, unequally distributed. That it is placed, in some form and to some extent, within the reach of all plants, is certain, since they all contain it. And a late scientific writer on Agricultural Chemistry in our country, has attempted to prove that all—even the poorest soils, possess an ample supply of it to furnish heavy crops of vegetation for countless years to come. If this were true, it would be worse than useless to expend labour in spreading it over our lands; millions of farmers besides myself have acted very foolishly, and you would do well to think no more of marling. But this is plainly not the case. There are a great many soils in which the chemical tests now known, have failed to find a trace of it. Such is the fact with regard, I believe, to all the land I cultivate. Such, I will venture to say, it is with regard to most, if not all of the lands in your county; though I am aware you have had pretended analyses made, which exhibited large proportions of lime. The reasoning of the writer alluded to, is this: All soils are formed by the disintegration and crumbling of rocks. Most rocks contain lime, especially those which disintegrate most readily and form soils. He calculates the amount of lime in the quantum of rock necessary to create a soil of a certain depth, and thence infers that there is so much lime in the land. There is no doubt that the rocks from which your soil and mine were formed, contained lime to the amount estimated. But it is equally certain that these rocks, in their transition from one state to another, were subjected for an indefinite period to the action of water. I am speaking particularly of our immediate section of country. The ocean once undoubtedly covered it as high up as the Falls of our rivers and the belt of Sand-hills which runs through the middle districts of South Carolina and Georgia, and held it as permanent domain. During this period, our marl beds were deposited—possibly also our present surface of earth. But whether that be so or not, and whether the surface we now cultivate belongs to the Eocene formation, as these marl deposits are supposed to do, or to the Post Pliocene, or, as is most probable, to the Diluvial, it is evident, from the irregular inter-stratification of different kinds of earth, and the rounded pebbles on and in it, to a considerable depth, which could have been rounded only by the action of water, that the whole of it, like the sand and clay now constantly brought down our streams, has been at some remote period, "drifted" from a higher region, and deposited by water here. The lime in the rocks being soluble under circumstances which must have attended the "drift," was retained and carried away in the currents. Our marl beds were probably deposited at a much earlier geological era, and have no connection with the soil on our present surface, but were upheaved or denuded in some of those great convulsions to which our globe has been every where subjected. That our lands are for the most part destitute of lime is certain. That it has been taken from them in this way, is more than probable. The masses of silicified shells to which I have already alluded, and which are so abundant in your county, prove that the lime may be entirely carried off by water.

But if there is no lime in the soil, from what source do the growing plants derive this indispensable constituent may be well asked? It has been often asked. Nature has not revealed, and science has as yet failed to discover an answer satisfactory to all. Whether, as is conjectured by some, the unknown vital action of the plant is sufficiently powerful and comprehensive to *create* the requisite modicum—or whether it can, as others suppose, by some galvanic agency, extract it from sources where its existence has not yet been detected by chemical re-agents, is yet a mystery. But this much experience has established and science demonstrated, that where lime cannot be found in fair proportions in a soil, the health and vigour of the plants growing on it can always be materially improved by a judicious application of it. And to this conclusion common sense, without experience or science, would lead every one who was aware that it is invariably an element in all vegetable matter.

The precise rationale of the action of lime on the soil, and the manner in which it benefits vegetation, has never been fully and minutely explained. Nature still holds many of the secrets of her laboratory undisclosed. Many, and many of the most important details of her wonderful processes of composition and decomposition and of the vast play of her chemical affinities, yet await the persevering investigation and penetrating thought of man. I will endeavor to lay before you, succinctly, what is known or rationally conjectured in regard to the operations and effects of lime, so far as may be material to the present purpose.

It is applied to land, either directly or mixed, in compost heaps, and carried out in manure. But for the additional labour the latter would always be the best method. Where it is used in large quantities, it is much cheaper to spread it at once upon the land, and apply manure, &c. afterwards, as circumstances may dictate or permit. It is sometimes put on land in the state in which it comes from the kiln, that is as quick or caustic lime. Sometimes it is first slacked in water, when it becomes a hydrate of lime. Most commonly it is slacked by mere exposure to the atmosphere, when it assumes the form of carbonate or mild lime, that is lime combined with carbonic acid, which it extracts from the air in the proportions I have already stated. It is in this form that it is found most abundantly in nature. Sulphate and phosphate of lime are also found, but quick lime never. The lime in shells, marble, limestone, marl, &c. is usually all of it the carbonate. Its action, however, in the long run, is always the same, whether applied in the mild or caustic state, being dependent on its intrinsic properties as lime. When caustic, it at first rapidly decomposes whatever of vegetable fibre or animal matter it comes in contact with. But its caustic quality is soon exhausted, or rather it soon becomes changed itself by the action of the substances it meets with, and thus loses its causticity. On lands containing a great excess of vegetable matter, such as peat and rich bog, and where rapid decomposition is desirable, quick lime is the best form of application, if equally cheap, as it saves time, and renders the soil productive much sooner than the carbonate will do it.

Although lime is found most commonly combined with carbonic acid, the fact is owing more to the abundance of that acid which exists in the atmosphere, in water, and is continually arising from vegetable decay, than because it has any affinity for carbonic over other acids. On the contrary, it will yield it up and combine in preference with almost any other. Not only the strong mineral, but most vegetable acids, even vinegar, as I have before mentioned, will drive it off. The effervescence which takes place when carb. of lime is thrown into them, is caused by the carb. acid escaping in the form of gas. From this great affinity of lime for all acids results one of its primary and most important effects in soils. Acids are antiseptic and arrest spontaneous decay. Lime combines with them wherever it finds them free from other combinations, and neutralizes their injurious effect. Hence, on lands that we call sour—and on many that are really sour without our knowledge of the fact—all land covered with broom sedge for example—it is of inestimable value. It destroys the sourness, and thereby promotes the decay of whatever matter may have been locked up by acids, which is calculated to nourish useful vegetation. From this quality of lime, it is denominated an Alkaline Earth—alkali being the reverse and antagonist of acid. Whenever an alkali and acid meet, they neutralize one another in certain proportions, and form what is called a salt. For instance, our common salt is muriatic acid, and the alkali soda. So carbonate of lime is in fact itself a salt.

These salts, and especially those of which lime is a component part, are of the highest value in agriculture. Some of them are soluble in water, and these are the most valuable. It is in fact only when they are thus dissolved that they afford any direct nourishment to growing plants which can imbibe nothing by their roots but watery solutions, and are fed altogether in this way from the ground. But the salts which are readily soluble in water are soon exhausted. Every shower dissolves them, and whatever surplus is left after the plants have absorbed the solution to the extent of their capacity, is liable to escape by evaporation, or to be carried by the water into the earth below the reach of vegetation, or to run off with it into the streams. Salts then that are not immediately soluble in water, if they can be made soluble gradually, are in the long run the most useful to the farmer. Of this class are most, if not all, of the salts formed by lime. Carbonate of lime is indeed wholly insoluble in pure water, and if lime remained forever in that state it would be of little value in the soil other than its mechanical influence on the texture of it. But if carbonic acid be added in excess—that is more of it than 44 parts in 100 which are required to make the carbonate, this salt becomes soluble. This excess is in point of fact constantly furnished in small quantities by the air, by rain water, and by the decay of vegetable substances in the ground, and hence, one advantage from keeping lime near the surface. The lime thus dissolved enters into the plant and feeds it. In this way, and this way only, is it a direct manure. All its other influences are indirect, on which account it is most generally regarded as a stimulant rather than a manure. I am speaking, of course, of carb. of lime as it exists in our marls, and not of the sulphate or phosphate of lime.

Its indirect action however is as important as it is varied. I have already said it promotes decay by neutralizing acids. But while lime from its neutralizing power promotes decay, by arresting the influence of acids and giving efficiency to the legitimate agents which accomplish it, it is a watchful guardian over their action, retarding their wasteful haste, and sometimes wholly preventing further progress for a time. It expels, for instance, from decomposing substances, ammonia, which is the most active and rapid conductor of putrifying contagion, driving it into the air to descend in future showers, or if they are at hand, into other substances less advanced in the stages of decay.

The ultimate result of the vegetable decomposition thus judiciously forwarded by lime, is a substance to which various names have been applied by chemists, such as, "*humus*," "*geine*," "*ulmin*," &c., which, so far as agriculture is concerned,—their treatment and influence on the growth of vegetation, are one and the same thing; meaning, substantially, that residuum of decomposition which is familiarly known to us as "*vegetable mould*," without a sufficiency of which in our soils, we are all aware that compensating crops cannot be made. In the progress of decay the most soluble portions of this mould are exhausted and assume new forms, and what at last remains apparently fixed in the soil is the undissolved sediment. This is said to be wholly insoluble in water, but when plowed up and frequently exposed to the action of the air, it becomes so, sparingly. Yet without aid from some other source, than the atmosphere, water will not furnish it to plants in sufficient quantities for their vigorous growth. Now the alkalies and alkaline earths (lime being the most important of this last class) act directly on this insoluble substance. Their presence—and it is a singular but well known principle in chemistry, that *mere presence is a power* called catalytic—induces it to absorb oxygen from the atmosphere, and to produce what is called humic acid. With this acid the alkalies immediately combine and form salts, called humates, which are soluble in water, and afford nourishment to plants. Thus when lime is properly applied to land, it brings into fruitful action the hitherto inert vegetable mould.

But it must be obvious that if no additional vegetable matter is given to the soil, the effect of lime will be to exhaust it utterly, in a shorter time than might otherwise be done by cropping. Hence the saying, that liming land enriches the father but impoverishes the son. It must not be forgotten, however, that the lime has enriched the father, by giving abundantly to his crops food that would otherwise have remained dead in his soil, or been eliminated by other agents, through a series of years, in feeble proportions, to scant, and therefore profitless crops: while, if it impoverishes the son, it is because a wretched hushandry has taken all from the land, and given nothing in return. The exhausting effect of lime is mitigated, however, by another highly important intermediate condition of the process. As the mould disappears, the proportion of lime to mould of course increases, and the lime becomes excessive. When this is the case, the humate, which before was soluble, becomes wholly insoluble in water. The process of decomposition then ceases for a time. And such is the case very soon, wherever lime or marl, in very large doses, is put on land possessing but little vegetable matter. It is called "marl burnt," among the marlers—many instances of which I can point out on my plantation. In course of cultivation, however, the lime being constantly exposed to the atmosphere, absorbs carbonic acid, which combining with a portion of it, converts it into carbonate of lime again, and thus freeing the humate, or a part of it, of the excess of lime, renders it soluble once more. But this is a very slow process, and unless there are immense quantities of vegetable mould which have been thus locked up by an extraordinary and injudicious application of lime, and probably even then, the proper plan is to remedy the evil at once, by a heavy coating of vegetable matter brought fresh from the woods. When this cannot be effected, we should give the land a long and absolute rest, allowing every particle of vegetation it produces to rot upon it, and if it can be conveniently done to plow it in. The best of all methods, however, to restore the land, and not always the most expensive, would be to add a sufficiency of compost manure. Besides the amount of decayed vegetation which such manure would supply, the alkalies potash and soda are always generated in compost heaps. These act directly on the insoluble humate of lime, decompose it by their greater affinity for the humic acid, and form new salts which are quite soluble.

Instead of objecting to this action of lime in locking up the food of plants, and its constant tendency to do so when that food is not made abundant by good husbandry, we should rather regard it as one of its most valuable properties. The vegetable mould was dead in the soil. It could not be carried away, but it was of little value as it stood. The lime by its presence persuades it to decompose in sufficient quantities to nourish a luxurious growth of plants. So soon as the mould begins to become scarce, the lime confines it in its embraces and preserves it from the wasteful influence of heat and moisture. Yet to the industrious farmer whose constant furrows give access to the atmosphere it yields up what a prudent economy would dictate under existing circumstances, to promote the growth of vegetation. If that vegetation is permitted to remain and decompose upon the land, "vegetable mould," in time, becomes abundant again, and the lime prepares it to furnish ample food for heavy crops once more. If all the produce is taken off, the lime, more provident than the farmer, and more generous too, still preserves what remains in the soil, for the exclusive use of the crop, and doles it out until all is gone.

The influence of lime upon the mineral substances of the earth is scarcely less powerful and important to the farmer, than on the vegetable. The chief mineral constituents of the soil are, as you know, sand and clay.—They are usually resolved by agricultural chemists into what they call silica and alumina, which are silicon and aluminum, their ultimate principles, with a little oxygen absorbed from the atmosphere. Of these two silica is much the most abundant as well perhaps as most valuable. After what we call clay has been deprived of its sand by washing, in which state it is usually denominated pure or agricultural clay, it still holds in chemical combination from 50 to 60 per cent. of silica. The purest pipe clay we find, is half silica; and the stiffest red lands of your county probably contain at least 70 per cent. of it, and not more than 15 per cent. of alumina. Lime and alumina have a strong affinity, and from their combination and subsequent decomposition results the important and well established fact, that the stiffest clay lands are rendered light and mellow by liming. The rationale of this process has never been satisfactorily explained. The effect is usually referred to the mere mechanical operation of the lime. But this cannot be so, since an hundred, or at most a few hundreds of bushels per acre of one earth, could not materially alter the texture of another, to any depth. It is probable that the crumbling of the clay, after liming, will be found to be owing to the condensation by severe cold of the carbonic acid supplied by the lime, and its extraordinary power of expansion under the influence of returning heat, since this disinteration of stiff lands has never been observed until a winter has elapsed after the application of lime or marl. Alumina will not combine with carbonic acid; and it may be that clay lands are opened partly by the incessant changes occasioned by the affinity of lime for both. Being insoluble in water, alumina furnishes of itself little or no aliment to the growing plant, though it has other indirect influences fully in proportion to its conspicuous position as a constituent of soils.

Silica, on the contrary, enters largely into the formation of the plant. It has, as I have mentioned, acid properties, and combines with the alkalies and alkaline earths and metals, forming salts of the greatest value in numerous points of view, which are called silicates. It is the silicate of potash, sometimes replaced by that of soda, and to some extent by that of lime, which forms the outer coating of straw, stems, stalks, &c., giving both strength and protection to the plant. These silicates are insoluble in water, so much so that they constitute the chief ingredient of rocks. But that universal and inexhaustible agent, the carbonic acid of the atmosphere, acting on the alkaline bases of the silicates, decomposes them: hence the gradual breaking down of rocks under atmospheric influence. The presence of lime is also known to influence the decomposition of the silicates of potash and soda, and at the moment of decomposition, both the silica and alkali are soluble. Thus, lime aids materially in supplying these essential elements to plants. Whether it does so by its alkaline properties, or by concentrating carbonic acid, or merely by its catalytic power, has not been settled. The silicate of lime itself, when rendered soluble by the decomposing influence of carbonic acid, sometimes, as I have stated, becomes, in their absence, a substitute for the silicates of potash and soda. It is this combination also, that renders light sandy lands more consistent, which is one of the most important effects of lime on such lands—particularly on the light uplands so extensively planted on this side of the Savannah, and in your county. The fact is unquestionable. It is usually referred, as is the opening of stiff lands, to the mechanical influence of the lime, but the cause assigned here, as in that case, is not adequate to the effect.

The red and brown lands in your county are colored, as they are every where else, by iron. You have no doubt observed that, after continued cultivation, some of the best of them cease to become productive without much apparent loss of vegetable mould, and are not rapidly restored either by rest or manure. Among other causes, this is owing, to a considerable extent, to the excessive oxidation of the iron in consequence of its exposure, from plowing, to the atmosphere, whence it extracts oxygen, a process you see constantly exemplified by the rusting of old iron. It becomes what is called a peroxide of iron, which is very injurious to vegetation. Lime neutralizes all acids, and if put upon these lands in proper quantities, it will neutralize a portion of the acid in the iron, and convert the peroxide into a protoxide of iron, which, if not actually beneficial, is at least harmless to plants. You have too, in some of your soils, the sulphuret of iron, so often taken for gold ore. This, on exposure to air, absorbs oxygen, which produces sulphuric acid, and then forms the sulphate of iron or copperas, which is poisonous to plants. If lime is put on the land it will arrest the accession of the sulphuric acid, thus formed, to the iron, and prevent the formation of copperas. But what is more, combining with the sulphuric acid itself, it forms sulphate of lime, commonly called plaster of paris, one of the most highly prized of all mineral manures, and an element in all, or nearly all plants. Lime has also the power of forming plaster in the same way when it comes in contact with sulphate of silicon, which is supposed to exist in all soils. It combines also with sulphuric acid, arising from vegetable decomposition or any other source, and produces this valuable salt.

The sulphate of lime, called also gypsum, as well as plaster of paris, must exist to some extent in all soils, as it is found in almost all plants. But, like the carbonate of lime, it is seldom to be detected by chemical tests. It may also be eliminated from unknown combinations by the vital action of the growing plant. But in the way I have mentioned, it will undoubtedly be formed in greater abundance in all soils, by the application of lime. Sulphuric acid itself is often used as a manure, but experience has fully established the fact, that it is of little value except on calcareous soils; and what is more remarkable, that sulphate of lime will also act with far greater effect on limed lands. I tried some of it myself the past year on marled land. I rolled the cotton seed in it, previously to planting them, and thus applied it at the rate of only one peck of the plaster per acre. I am satisfied that the product, on the few acres to which it was applied, was one third greater than on similar adjoining land, marled also, but not plastered. I anticipate, therefore, the greatest benefit from the use of plaster after marl. I should remark, however, that it has not been found invariably beneficial even on limed lands. In England, and on our coast, south of Long Island, little advantage has been derived from it. Two probable causes have been assigned for this: the influence of sea air, which has not been satisfactorily explained, and the probability that the lands in the regions mentioned have derived a sufficiency of gypsum already from the sulphuret of iron, or other sources. Very little is required for plants: one peck per acre applied to the moistened seed will probably have as much effect, for one year at least, as any other quantity. In the last dry season it had, on my land, double the effect of a bushel sown broadcast. Five to ten bushels are sometimes applied.

Phosphate of Lime is even more esteemed for a manure than the Sulphate. It is sometimes called the "Earth of Bones," as bones contain over 50 per cent. of this salt. Being less abundant than sulphate of lime, it is much more costly. Bones are transported across the Atlantic to England, to be used as manure. Several hundred vessels are now engaged solely in transporting bones from various parts of the world to England. This phosphate is also an essential constituent of plants, though rarely to be detected in soils. But phosphoric acid, like sulphuric, arises from vegetable decomposition, from phosphuret of silicon, and perhaps other sources. If lime be present in the soil to fix it, not only is the vital action of the plant relieved from producing it, but much is probably saved that would otherwise be lost. The ash of cotton seed contains considerably more of this acid than bones do, and hence the immense value of this seed as a manure. But its effects are proverbially transient. With lime in the soil sufficiently abundant to fix the phosphoric acid, cotton seed would be a manure almost as permanent as bones. But to detail all the operations of lime in the soil, in assisting to prepare food for plants out of the vegetable and mineral substances—which compose it—would require me to write a much longer letter than you would read with patience. I have touched on the most prominent only. The general consequences, however, which follow, and which are regarded as arising peculiarly from its applications to land, require to be glanced at.

By opening stiff land, it renders it more permeable to the air, and more subject to atmosperic influence, while its surplus water more readily escapes. Quick-lime, when saturated, holds more water than common clay, such as yours, but yields it more readily to heat, and is therefore of great use in drying damp lands and rendering them warmer. But it does not give up its water so promptly as sand, and therefore renders that more retentive of moisture. In fact, Marl containing 50 per cent. of carbonate of lime, and the residue chiefly fine sand, will absorb more water than the common clay of your lands, and retain it as long. During the extreme drought last year, at one time, the plow turned up dry dirt in a field of mine marled that year at 100 bushels per acre, and not yet sufficieutly mixed in the soil, while several days later, without intervening rain in a soil equally sandy and having less vegetable matter, but marled four years ago with 200 bushels per acre, earth quite moist was turned up at the same depth. You will readily perceive and appreciate the value of marl in this respect.

By rapidly neutralizing the noxious, and vivifying the good properties of the subsoil brought up in breaking land, lime enables the farmer to deepen his soil more speedily and without risk. Mr. Ruffin's experience confirming the theory, is decisive on this point; mine, so far as it goes, is to the same effect. Lime undoubtedly hastens the maturity of crops. Writers abroad state that it advances them a fortnight. Before seeing these statements, my observation of my own crops had led me to the same conclusion. Two weeks gained to the cotton plant is equivalent to a degree of latitude—a very material gain to us.

It is also stated on good authority, that lime in land improves the *quality* of every cultivated crop—and that it has the effect of increasing the fruit in proportion to the weed. It is well known, that while the straw, stalks, &c. of plants, contain more of the carbonates, the seeds contain more of the phosphates. If the application of carbonate of lime increases the fruit more than it does the stalk, its indirect influence in producing phosphates is greater and more important than has been generally supposed, and its value is enhanced in a corresponding degree. It is said also to extirpate many noxious weeds. However this may be, I can testify that it gives great luxuriance to the growth of all the grasses with which our crops are infested. This, to the mere corn and cotton planter, may be no recommendation of it. I will state, however, that in a field planted in cotton in 1844, and rested last year, which usually produces a heavy crop of hog-weed, when turned out, there came up, although it had not been plowed at all, an uncommonly fine growth of crow-foot; which I can only account for from its having been marled. The part longest marled had the best crow-foot.

Lime is thought in England to prevent smut in wheat—to destroy many injurious insects—to preserve sheep pastured on land after its use from rot and foot-rot—and it is every where regarded as improving the healthfulness of drained lands. In short, it is now generally agreed, not only by scientific men, but by the best and most experienced farmers in every part of the world where it has been properly tested, that "Lime is the basis of all good husbandry,"—in which opinion I fully and cordially concur.

In endeavouring to furnish you with something like a theory of the action of Lime, I have stated some—perhaps many things—which are questioned by men of great scientific attainment. Agricultural Chemistry—indeed the whole science of chemistry—may be said to be yet in infancy. If it is difficult to penetrate the arcana of passive nature, it is far more so to investigate those active operations which are conducted in the air and under the ground, in the formation of plants, complicated as they are in addition by the yet unknown vital agency of the plant itself. Although, on the whole, the art of agriculture has been vastly advanced by the discoveries and experiments of chemists, and he who shuts his eyes to the light they are constantly shedding for the benefit of farmers, is now, and will soon be much farther, behind his age; still it is well known that great absurdities have been put forward, and with the utmost confidence, by the most eminent characters in modern science. In speaking, then, of the peculiar action of any of the elements out of which plants are formed, and its agency in the mysterious operations consummated in the production of a full-grown, matured and fruit-bearing plant, it is not only becoming, but necessary that every one, most especially a mere farmer like myself, should express opinions with great diffidence and caution, and hesitate before drawing even from established facts, inferences of important and extensive bearing. In view of this, I ought not to omit to state to you, that within a few years past, a sweeping theory has been suggested by one of the first chemists and most popular writers of the age, that has found some able supporters, and which if true apparently upsets every thing that has been said of the effect of lime in furnishing food to growing plants out of decayed vegetable matter. Dr. Liebig asserts that the decayed vegetable matter of the soil called humus, or mould, affords no direct nourishment whatever to plants. That they derive all their organic constituents from the atmosphere, and only their inorganic from the earth. The organic constituents of plants are those which are dissipated when they are burnt, and in most vegetables amount to from 97 to 99 parts in 100. The inorganic constituents compose the ashes which are left by fire, amounting usually from 1 to 3 parts in 100, in some rare cases to as much as 12 per cent. The only nourishment which, according to this theory, the soil affords to plants, being thus limited to from 1 to 3 parts in 100, the utmost direct influence of good or bad soils, of manure of all kinds—of lime, alumina, silica, and all mineral elements, can reach no further than to the modification of an hundredth or at most a thirty-third part of the crops we cultivate. It follows that the world has all this time laboured under a most important error in estimating at such vastly different values, what we call rich and poor lands. That the effects of manure are in a great measure fanciful, or at least that from 1 to 3 lbs. of ashes are equivalent to 100 lbs. of vegetable matter, as an application to the soil, and that it is useless labour to put on manure in any other form. Knowing as we do that a single drop of prussic acid will almost instantly extinguish life, it would not be fair to deny very great influence to even the smallest proportion of inorganic matter in the production of plants. And since Liebig concedes that until the leaves are formed, the plant derives its carbonic acid from an artificial atmosphere generated by the contact of humus in the soil with the air, it would not be safe to denounce this theory in the present state of science, as absurd. It is admitted too on all sides that plants do assimilate carbon from the atmosphere, and it seems established that ammonia descends in rain water. However true this may be, and though Liebig's theory was established as perfectly so in all its parts, I should think it most prudent to hold on still to what experience and rational deduction have taught us of the influence of vegetable mould on crops, in the hope that further discoveries might harmonize old facts and new truths, especially as none of us would set about improving the atmosphere, or desire to add more carbonic acid or nitrogen to it, since any material increase of these elements would render it fatal to animal life. Indeed, no scientific discoveries or force of logic can ever, I am convinced, for an instant shake your confidence or that of any practical farmer, in vegetable mould and compost manure; or lead you to doubt that the amount of your crop, if properly tilled under fair seasons, depended in all other respects wholly and solely on the quality of your land. Whether the soil furnishes 1 part or 99 parts in a hundred—you have too often seen plants on the same acre subject to the same identical atmospheric influences throughout, varying from good to worthless, according to the soil, to question the important fact that by improving your land you improve your crop in the same ratio precisely, and that by exhausting it you equally deteriorate the crop.

In fact, depth of soil, by which we mean depth of decayed vegetable mould, depth of decayed vegetable mould mixed with sand, clay, &c., has been with you, as with all the world, heretofore, a criterion, and a never failing one, of the value of land, and so it will forever continue to be, I venture to assert. If then, as I believe, and you will probably agree, plants derive their most important constituents of all kinds from the soil and from vegetable mould, the value of lime in the soil is by no means limited to its action on the mineral or inorganic constituents of it, but extends to the production also of those organic elements which preponderate so immensely in all vegetation.

But your inquiry of me was in reference to Marl. I must therefore remind you again, that all which has been said of lime is true of marl. If it is slower than lime in its early operations, that is more than compensated by many advantages which it possesses. This is becoming so well understood, that wherever the same quantity of lime can be placed on land as cheaply in the form of marl, it is rapidly superseding the use of it in all other forms. Marl contains besides carbonate of lime other valuable constituents. Its silex and alumina though fine in quality are not of much consequence, since they are never thus applied in sufficient quantities to effect the soil materially. But some marls—those in Virginia, for instance—contain sometimes sulphate of lime and the valuable green sand of which I have spoken. As the sulphate of lime exists there in Eocene Marl it may be discovered in our formation. I have seen green sand in specimens from several localities in this State. A deposit of green sand, such as is found and used to an immense extent in New Jersey, would be more valuable in your county than the richest gold mine in the world. There is none of it at Shell Bluff. I have already spoken of phosphate of lime. In marl from Ashley river, in this State, which belongs to the same formation as our marls, 5 per cent. of this phosphate has been discovered. From some crude experiments of my own, I am inclined to believe it exists in some of the marls at Shell Bluff, and probably in yours—to what extent I would not undertake to say. But 5 per cent. of it would give you the equivalent of 9 bushels of ground bones in every hundred bushels of marl, which alone would be worth more than the whole cost of applying that quantity of marl, though the expense of it might be five dollars. We cannot, however, expect to find it in such quantity in all the marls we use. Those will probably be richest in it in which are found remains of bones and teeth. In the shell marls on the Rhine, recent analysis has detected an important proportion of azote, derived it is supposed from animal matter. This is the most powerful, as you know, of all manures. There is every reason to believe that a scrutiny equally rigid would disclose a valuable proportion of it in our shell marls here.

The duration of marl in the soil, is undoubtedly greater than that of lime. The question of the duration of calcareous earth applied to lands, is one of great importance itself, and about which you will no doubt desire to be satisfied before attempting to use it. I have mentioned already, that the ancients regarded marl as producing its effects from 10 to 80 years. Lord Kames states an instance of their being observable for 120 years, and Mr. Ruffin another of 60 years. Few or no records of such experiments have been handed down from generation to generation. In those countries where lime and marl have been used most extensively and for the longest period, it is impossible to say how the land produced before they were applied at all, in comparison with its production now. Of late years, more accurate accounts have been kept. The peculiar effects first observed to follow the application of lime, have been thought to disappear or materially diminish at various periods, reaching from 4 to 40 years, according to the amount applied and other circumstances. It is supposed by writers and farmers abroad, that about $3\frac{1}{2}$ bushels of it are consumed per annum by the crop, and that in general the influence of any quantity will cease in from 12 to 20 years. But these conclusions are not to be relied on. It is certain that no crop will take off so large an amount as $3\frac{1}{2}$ bushels, and the loss from other causes is altogether indefinite. While though at the end of 20 years, the same precise effects as at first may no longer be observable, it by no means follows that this may not be owing to the want of proper applications of other manures that would excite the lime again to its original action. Mr Ruffin thinks that marl once placed on land, will endure as long as the clay and sand in it. Though we might not indulge fully in this belief, I am of opinion that it will last for a period which may be called indefinite, from its remoteness—particularly when crops are grown such as we cultivate. Irish potatoes consume more lime than any other crop, perhaps; nine tons, which are sometimes grown upon an acre, though not with us, abstract about 266 lbs. or say $3\frac{1}{2}$ bushels—but 260 lbs. are contained in the tops, which we never take from the land. A thousand bushels of turnips, tops and all, consume about 2 bushels of lime. Wheat, the cultivation of which is extending among us, requires for a crop of 25 bushels, straw and all, about 9 lbs. or a half peck. Cotton and corn do not require more. Seed cotton sufficient to make a bale of 400 lbs—that is 1400 lbs. in the seed will consume about 3 lbs., and most of that in the seed which is invariably restored to the land. If we treble this amount for the stalks and leaves, which however usually rot on the groond, the exhaustion of lime by our heaviest cotton crops will not exceed half a peck when every thing is taken off. Thirty-five bushels of corn will consume only about $1\frac{3}{4}$ lbs. of lime; if we add six times this amount for the cob, shuck, blades and stalk, it will not require more than cotton or wheat. I am not aware that our cotton stalks, or our corn-cobs, shucks, stalks or blades, have ever been analyzed; but I have, I think, fully allowed for the lime they may contain. And at these rates of exhaustion, 30 bushels of lime, which is about the quantity contained in 100 bushels of marl that has 60 per cent. of the carbonate, will supply the wants of our usual crops, when much larger than we now average, for 240 years, if the land was cultivated so long without rest or restoring any thing to it. The consumption of the crop then is next to nothing. The loss arising from other causes is undoubtedly greater. Quick-lime dissolves in 750 parts of water. A fall of 44 inches of rain, which is less than the annual average quantity that falls here, would afford water sufficient to dissolve 170 bushels per acre. Quicklime when spread on land, however, becomes a carbonate, and nearly insoluble, too soon to lose to this extent. Still, a considerable amount might be lost in this way, by a heavy rain immediately after liming. Lime after being burnt, falls into a powder. Its minute particles are forced by showers, aided by deep plowing into the subsoil, and much may be thus carried off. When these things are considered, it is obvious that all the lime in land may in time be exhausted, as it has been from our "drifted" soils. But the chances of its duration are greatly increased by being applied in the form of marl. Being a carbonate, it is soluble by the carbonic acid in rain water only in small quantities, and ages must elapse before it could dissolve and carry off any great amount; and not having been reduced to a fine powder, its particles are too large to be readily driven down into the subsoil, below the reach of the plow. Without, then, assigning any precise limit for the duration of marl, I think it may be safely concluded, that the effects of a sufficient application, under proper culture, will last for a longer period than we can conceive ourselves to have any direct interest in the land to which we may apply it.

With regard to what is a sufficient application, there is a great diversity of opinion, and consequently of practice. Viewing it chiefly as a direct manure, in many parts of Europe, lime is applied at the rate of 8 to 10 bushels per acre annually—in others, at 10 to 12 bushels every third year; and again, in other parts, at 40 to 50 bushels every twelve years. But as its indirect effects are as important, and far more numerous than its direct, and it is therefore an invaluable elementary constituent of soils, the true rule for its application undoubtedly is to furnish the soil at once, if possible, with as much as its constitution will bear, and to repeat the dose as frequently as the improvement of that constitution will permit, since the more lime, every thing else being in due proportion, the larger the crops. Acting on this principle, many farmers in Europe put on 3 to 400 bushels of lime at once, and sometimes 1000. Such liming is probably excessive there, and in our climate would be utterly destructive. Marl, however, containing from 50 to 70 per cent. of carb. of lime, may be safely used in four times the quantity we can use quick lime. The usual dose of marl of that quality in Virginia, varies from 2 to 300 bushels. But more can be applied even in Virginia than here. The hotter the climate, the more caution is necessary in the first dose at least. Though this is greatly dependent on the condition of the land to be marled. In the hot and dry climate of Egypt, the fruitful Delta of the Nile contains 25 per cent. of carb. of lime, which is equivalent in one foot depth of soil, to some 20,000 bushels per acre of marl containing 50 per cent.; but that soil is much deeper, and its vegetable mould inexhaustible. Depth of soil, and the amount of vegetable matter in it, must chiefly regulate the quantity of marl. M. Puvis has given an interesting table in reference to this. He thinks that we may give to a soil three inches deep, 40 bushels of marl, containing 60 per ct. of carb. of lime, or 50 bushels containing 50 per ct.; and to a soil six inches deep, 80 bushels at 60 per ct., or 100 at 50 per ct. He does not refer to the vegetable matter, or other circumstances of the soil. I presume that the depths of the soils you cultivate range between the extremes stated, or at least that you seldom plow, and would not, therefore, mix the marl deeper than six inches. I think the amounts he specifies are very safe. As some of my lands are similar to yours, and our climates the same, I will give you my experience on this point. I began to marl by putting 200 bushels per acre, that averaged about 60 per ct. carb. of lime. On old mulatto land, with a soil about six inches deep, and containing about 4 per ct. of vegetable matter, I have not yet, after four years, perceived any injury from it. On lighter land, containing less vegetable matter, and a soil four to five inches deep, I discovered marl burns the second year. Previously to this discovery, however, I had taken the alarm, and reduced the quantity to 150 bushels, on land similar to the last mentioned. On all the thin spots I perceived the "marl burn" from this amount. I then further reduced the marl to 100 bushels per acre, from which I have as yet perceived no injury. Being now about to finish the marling of all my open land, it is my intention to go over it again, and to add 50 bushels per acre at a time, until I have given to all 200 bushels. I shall by no means, however, venture to do this until, by resting and manuring, I have also furnished to it additional vegetable matter.

I think I may safely recommend you to apply 100 bushels per acre, of the richest marl you have, to any land that now gives you remunerating crops, and 200 bushels, or more, to your best lands. If they are low and sour they will bear still more. I am now putting 250 to 300 bushels on some swamps I have drained, which have several feet of vegetable mould. I should not be afraid to put 1000 bushels per acre on such land—though here I think quick lime would be the best application, as it would hasten decomposition.

It is always most convenient to apply marl to resting lands, and it is also a great advantage to secure, by this means, a new coat of decaying vegetation to start with. So new grounds should be marled the first year: if marled before clearing it would be better still. Very old and exhausted land should be rested two years previously to marling; and in all cases, thin knolls should, if possible, be manured when marled. But a little experience will furnish you the best guides in this regard—you will soon discover all the dangers, and learn to apply all the remedies.

Experience will also teach you in a very short time, the best and most convenient methods of digging, carting, and spreading marl. There are some difficulties connected with digging from marl pits, which, with the means of overcoming them, are stated in Mr. Ruffin's work. They arise chiefly from water, which must be drained off, or pumped out, according to circumstances. I have no experience on this point. My marl is cut from the face of the cliff at Shell Bluff. It is estimated that if a strata of marl is 12 feet thick, 12 feet of covering may be removed to procure it, without hazarding too much. But should you find marl, you need not apprehend much danger of working through it. The great formation of which it is a part, is of unknown depth. Over 100 feet of it is exposed at Shell Bluff; it has been penetrated more than 300 feet in Charleston.

In hauling out marl, the most economical method is to use carts with two mules or horses. In a cart properly made, they will haul 18 bushels at a load as easily as one mule will haul 6. The carts should be made with three shafts, so as to divide the weight of the load equally between the mules, and the tread of the wheels should be 4 inches—axle-trees of iron. In putting on 100 bushels to the acre, the land should be divided by furrows into squares 28 yards each way. This will give 6 to the acre. A load of 18 bushels to each square will rather exceed 100 bushels per acre, but some will always be lost. The full effect of marl cannot be felt until it is thoroughly mixed with the soil. Hence the first year, little is to be expected from it, and it seldom reaches its maximum until the fourth crop—not always then. Its effects may be hastened, and what is also important, rendered equal, by spreading it with regularity over the land. It is best, therefore, to sow it broad-cast with the hand. Each labourer should take his square and spread the pile, using a tray or board to assist him. A hand will spread 9 piles, of 18 bushels each, in a day.

The distance to which marl may be carted depends altogether upon circumstances—one of which is the quality of the marl—another, that of the land—others, the facilities for digging, state of the roads, &c. Along the coast of Scotland, it is transported by sea from 80 to 100 miles. I have been very recently informed, that at a single marl bank on James river, in Virginia, 10 rigged lighters are now engaged in delivering marl to a distance of from 8 to 20 miles up and down the river, receiving 3 cents per bushel for it, though it is much inferior to ours in quality. The marl I use, averages about 60 per cent. of carbonate of lime. I cut the whole of it down at Shell Bluff, and boat it 12 miles up the Savannah river, re-land and cart it. I have marled about 700 acres within a mile of my landing here—but I have hauled some marl 4 miles, and have spread it on about 500 acres, the nearest part of which is over three miles from the river. This is of course very expensive; but I think it profitable, notwithstanding. If I could lay down any rule to regulate the cost of marling, it would be this: That where land is deficient in lime, it would be a safe operation to expend an amount equal to the present value of it, if so much should be necessary to marl it sufficiently. This rule I suggest upon the principle, that it would be profitable to pay twice for land, if you could thereby double its production without materially increasing the cost of cultivation.

You will naturally inquire, whether any one might reasonably calculate on doubling the production of his land by marling. I believe he may, if the marl is judiciously applied and the proper system of after-cultivation adopted. I have seen but few statements of the actual results of marling in Europe. It is said in general terms to produce a great increase, though occasionally it is mentioned that the crops were doubled. So perfectly established is the use of lime and marl there, that every one who can procure them, uses them as a matter of course. It is not considered an experiment, and tables of results are not therefore given—at least, I have seen none. A few years ago, Mr. Ruffin addressed interrogatories touching the effect of marl as exhibited in the crops, to a number of the most respectable farmers of Virginia, who had used it, and received answers from twenty-two, many of whom had marled extensively and for a number of years past. These answers were published in the Farmer's Register and in Mr. Ruffin's Report of his Agricultural Survey of South Carolina. Their marl was of various qualities, applied in various amounts per acre, and on different kinds of land, which had been subjected generally to very severe cropping before. No one of these estimated the increase of his crops from marling at less than double, and some of them rated it as high as 400 per cent. I have no doubt, that under favourable circumstances and good management, the last mentioned increase, enormous as it is, may be often realized. The prospect, however, of doubling the crop with reasonable certainty, is promise enough one would think, to set every one to marling who can do it within the cost I have mentioned. I have not myself, yet doubled my own crop by the use of marl, nor might the practical results of it, which I ought to state, be so striking to a careless observer as he might expect, after all I have said on the subject. They satisfy me, however; and I feel perfectly certain that in a short time, the crops on all the land I plant, will be at least doubled, from the effects of marl alone, and much more than doubled, in consequence of other additional applications I am making. I commenced marling in November, 1841. I marled only 175 acres for the crop of 1842, the results of which I reported to our State Agricultural Society, as I did those of 1843, on the same land. They were published, and some of you may have seen them—I will therefore only repeat the tabular statement of those years, and add to it that of the past year. In 1844, these lands rested. The experiment marked No. 1, was made on mulatto land lying on the river bluff, which in appearance, and perhaps in most other respects, is much the same as the best upland cotton soils in your county which have been as long in cultivation. Experiment No. 2, was on light, sandy soil,—the sand is very fine, but altogether, the soil is as inferior as any probably that you plant in cotton. I could scarcely have selected lands less calculated to give the marl a fair chance—both having been cleared more than a century ago—badly scourged, and of course greatly exausted of vegetable matter.

Experiment No. 1. Mulatto Land.

1842.	*Seed Cotton.*	*Less than unmarled acre.*	*More than unmarled acre.*	*Pr. ct.*
Acre not marled.	1111 lbs.			
Do. marled 100 bush.	846 "	265 lbs.		30.
Do. do. 200 "	1003 "	108 "		10.7
Do. do. 300 "	1318 "		207 lbs.	17.7
1843.				
Acre not marled.	493 lbs.			
Do. marled 100 bush.	654 "		161 lbs.	32.6
Do. do. 200 "	759 "		266 "	53.9
Do, do. 300 "	841 "		348 "	70.
1844.				
Rested.				
1845.				
Acre not marled.	324 lbs.			
Do. marled 100 bush.	481 "		157 lbs.	48.4
Do. do. 200 "	584 "		260 "	80.2
Do, do. 300 "	642 "		318 "	98.

Experiment No. 2. Sandy Land.

1842.	*Corn.*	*Less than unmarled acre.*	*More than unmarled acre.*	*Pr. ct.*
Acre not marled.	17 bush.			
Do, marled 100 bush.	21 "		4 bush.	23.5
Do. do, 200 "	21		4 "	23.5
Do. do. 300 "	18½ "		1½ "	8.8
1843.	*Seed Cotton.*			
Acre not marled.	361 lbs.			
Do. marled 100 bush.	451 "		90 lbs.	24.9
Do, do. 200 "	384 "		23 "	6.3
Do, do. 300 "	173 "	188	..	108.6
1844.				
Rested.				
1845.				
Acre not marled.	230 lbs.			
Do. marled 100 bush.	317 "		88 lbs.	37.7
Do. do. 200 "	301 "		71 "	30.8
Do. do. 300 "	159 "	71	..	44.6

The first thing that will strike you on looking at this table, will be, that the crops have regularly and excessively diminished, from the time the land was marled. It might be concluded that I had ruined my land by marling. Such I will candidly own would have been my own conclusion, if fortunately I had not kept these unmarled acres to test the success of my operations. Disastrous as have been the three last crop seasons in this section of country, I would not have believed it possible that there could have been such a falling off from seasons alone, and I should have abandoned marl, in spite of the experience of the rest of the world, as injurious, at least to my soil. But great as has been the decrease of production on all the acres, it has been far greatest on the unmarled ones. That of the others, has comparatively steadily increased, except the 200 and 300 bushel acres in No. 2, both too heavily marled, but both recovering again under the rest of 1844. In No. 1, the acre with 100 bushels has increased from 30 per cent. below, to 48.4 per cent. above the unmarled one—making an actual comparative increase of 78.4 per cent. The acre with 200 bushels, has in the same way increased 90.9 per cent. Both these acres are decidedly inferior to the other two in No. 1, and have, I do not doubt, produced this year double what they would have done without marl. The other two acres in No. 1, are a pretty fair test of the influence of marl, being as nearly equal in quality as could have been selected. The sandy land, in time and with proper management, will, I am certain, exhibit results fully as favourable as the mulatto land. It was too far exhausted when marled. I did not reserve test acres on any other fields, but I feel sure that they have derived equal advantage from the marl, in proof of which I could state many facts to one present on the spot, which it would be tedious to mention and explain fully in this letter. I will only state one: The unmarled acre in No. 1, is one of the best acres I plant. In 1842, it yielded 1111 lbs. The average of my whole crop that year, was 666 lbs. per acre. The last year, the same acre, *after a rest*, produced 324 lbs. The average of my crop was 391 lbs. per acre. Thus, the yield of the unmarled acre, was in one instance 66.8 per cent. above, and in the other, 20.6 per cent. below the general average—making a difference of 87.4 per cent. in favour of the marled lands. Let me add that in 1842 the unmarled acre in No. 2 produced 8.8 per cent. less than the average of the crop. In 1843 it fell to 37.6 per cent., and in 1845 to 70 per cent. below the general average. If these facts may be assumed as data, on which to base a calculation, had the last year been as favourable in all respects as 1842, the average of my cotton crop must have been over 1200 lbs. of seed cotton per acre, and of my corn crop over 28 bushels per acre. This however is only a *paper* calculation, and 1842 was a fine crop year. Time will reveal the truth.

I cannot give you a better evidence of the firmness of my faith in the virtue of marl, than to state, that notwithstanding the discouragements of the last three extraordinary seasons, I have, at great expense, brought up from Shell Bluff, within four years, over 300,000 bushels, carted it out, and spread it over about 2300 acres of land; and am at this moment as actively engaged at it as ever. Nor do I look forward to a period when I expect to cease using it to a considerable extent every year, either on fresh lands, or in increasing the dose on those already marled. It would be leading you into error, however, to leave you to suppose that I rely solely on the marl to improve my lands. Rest, in connection with it, is indispensable, and manure becomes far more beneficial. I have, accordingly, by opening more land, and reducing my planting, enabled myself to rest, annually, one third of my fields. And I have already hauled out and mixed together, for the coming crop, 96,000 bushels of muck, and 48,000 bushels of manure from stables and stable yards, hog and ox pens, &c., having yet about 20,000 bushels more to carry out before planting. I shall not only endeavour to increase this amount of manure every year hereafter, but also, by clearing and reducing the land in cultivation, to rest, as nearly as may be requisite, each field, every other year. Indeed, the management of land, after it is marled, is of the utmost consequence to the efficiency and profit of marl. Though lime is itself a portion of the food of plants, and therefore a manure, this is perhaps the very least of its virtues. Its indirect operations are far more important. It is the grand agent that prepares for the crop nearly all the food which the earth furnishes. It is the purveyor general—no—the Farmer must fill that office: it is the "*chef de cuisine*" that selects the ingredients, mixes, and seasons almost every dish to suit the delicate appetite of the growing plant. It is from the materials placed in the soil by nature, or the industrious husbandman, that this skillful artist draws the rich repasts it furnishes; and it could no more furnish them without these materials, than your cook could make your soup without joints and spices. The larder of the marl must then be amply supplied. The means of doing it are rest and manure. The great gain to the farmer is, that having once engaged in his service this powerful, untiring, and almost universal agent, he may safely exert himself to the utmost of his ability to supply it with every thing necessary to carry on its important operations. Seizing on whatever is valuable, it preserves it from waste—combining with the utmost generosity the wisest economy, it not only yields to the plant all it requires, but stimulates it to ask more, while it is inaccessible to demands from all other quarters.

There is no fancy in this—Theory and experiment unite to prove it true. And I trust that no great length of time will elapse before marl shall have written its own eulogy in indelible characters over all the broad fields of your county.

Permit me to conclude this letter, for the great length of which I owe you an apology, by returning my acknowledgments for the honor you have done me in electing me an honorary member of your Society, and by wishing each member of it the utmost success in his agricultural pursuits.

I am, very respectfully,

Your ob't. serv't.

J. H. HAMMOND.

Hamilton Raiford, Esq.
Corresponding Secretary of the Agricultural
Society of Jefferson Co., Georgia.