THE

# SOUTHERN PLANTER.

Devoted to Agriculture, Horticulture, and the Household Arts.

Agriculture is the nursing mother of the Arts.—*Xenophon.* | Tillage and Pasturage are the two breasts of the State.—*Sully.*

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For the Southern Planter.

## J. B. LAWES AND JUSTUS VON LIEBIG.

Nearly twenty years ago, an English land owner, John Bennett Lawes, instituted on his home farm, at Rothamstead, in Hertfordshire, some experiments on the action of different chemical combinations when applied as manures to the various crops of English agriculture. In 1843, he secured the assistance of Dr. J. H. Gilbert, and commenced on a large scale a series of experiments on wheat, turnips, beans, peas, tares, clover, &c. Dr. Gilbert, assisted by other able chemists, devoting his entire time to the work.

A field of 14 acres, after having been impoverished as much as possible by the growth and removal of four crops without manure, was divided into upwards of thirty plots, and set apart for a series of experiments on wheat. Another field of eight acres, of similar soil, was prepared in the same way, divided into a number of plots and devoted to a series of experiments on turnips. Another field of similar soil was treated in the same way and devoted to experiments on beans, peas, tares, &c. The various plots have been kept distinct to the present time, and in the wheat field each plot has been sown to wheat every year. In the turnip field, turnips have been grown on each plot every year up to the present time. So of beans, peas and tares.

One plot in each field has been left without any manure since the commencement of the experiments. The other plots were dressed with some one or more of the organic and inorganic elements of plants. The produce from each plot was kept separate, and the weight of grain, straw, &c.; and in the case of turnips the weight of buds and leaves accurately ascertained. The increase of produce over and above that obtained from the continuously unmanured plot was ascribed to the particular manure used.

Some of the results of these experiments have been given to the public at various times through the *Journal of the Royal Agricultural Society* of England, the *Agricultural Gazette*, and the *Journal of the English Association for the advancement of Science*, periodicals which are seldom seen by American farmers; and it is to be regretted that, with a single exception, none of Mr. Lawes articles have ever been republished in this country.

When he associated himself with Mr. Lawes, Dr. Gilbert had but recently returned from Giessen, where he received the diploma of Doctor of Physolophy from Prof. Liebig, and it is not improbable that he entertained some of the views of this distinguished chemist in regard to the manurial requirements of plants. Be this as it may, it is evident that the manures used the first year on the wheat field were selected with reference to the "*mineral theory.*" They were composed of the constituents of the *ashes* of the wheat plant. They were applied in various quantities and combinations, but *failed in every instance to increase the yield of wheat.* On the other hand, where ammonia was used, the crop was greatly increased; and this, in a word, has been the prominent result of the experiments on wheat every subsequent year throughout.

These results were thought to be inconsistent with the mineral theory. They were supposed to prove, that although a soil abounded with the mineral elements of plants in an available condition, the atmosphere, rain and dews could not supply ammonia sufficient for a maximum crop of wheat.

Prof. Liebig, on the point of editing a new edition of his "Chemistry in its Application to Agriculture and Physiology," has had occasion, as he tells us, to examine the agricultural journals, in order to acquaint himself with the results of practical experience, that have been published since the appearance of the last edition of his book, in 1845. The result of this examination has led to the simultaneous publication in Germany, England, and the United States of a pamphlet entitled "The Relations of Chemistry to Agriculture, and the Agricultural Experiments of Mr. J. B. Lawes." The object of the pamphlet we will allow Liebig to state in his own words:

"The experiments of Lawes, of Rothamstead, are distinguished above all others by their extent and duration; and since the conclusions that their author has deduced from them stand in contradiction to the principles which I have taught in the above work, I consider his so-called practical criticism of scientific views especially adapted to serve as an example to convince agriculturists how necessary it is to select a correct method of experimenting, when, thereby, an opinion or doctrine is to be confirmed or refuted."

"All the experiments of Lawes *prove precisely the contrary of that which, in his opinion, they should prove.* I consider them, indeed, as the firmest support of the theory which they were originally intended to combat, and the facts which he has ascertained, teach so many important doctrines in reference to the cultivation and manuring of the soil, that I hold them to be of very special value to the theory of agriculture."

Lawes' experiments are "the firmest support" of the "principles" taught by Liebig, and are of "very special value to the theory of agriculture," and calculated to teach "many important doctrines in reference to the cultivation and manuring of the soil." What, then, are the principles taught by Liebig, and what are the results of Lawes' experiments?

It is by no means easy to answer the first question. An eminent German philosopher has said that Leibig's writings "*swarm* with contradictions;" and Dr. Hugo Mohl characterises his style as one "which leaves the reader, on almost every important topic, in perfect uncertainty what it really is that Liebig means."

The principal point of difference between Lawes and Liebig is in regard to the so-called "mineral theory," which Mr. Lawes thought embodied in the following sentence in Liebig's "Chemistry in its application to Agriculture and Physiology": "The crops on a field *diminish* or *increase* in *exact proportion* to the diminution or increase of the mineral substances conveyed to it in manure." Liebig says Mr. Lawes appears to be unacquainted with any other sentence in his book, "*and this sentence he has entirely misunderstood.*" Again he says, "It is impossible to believe that he (Mr. Lawes) had any knowledge of this theory or was acquainted with my doctrines, otherwise, how could he have declared my opinions to be inconsistent with his experimental results?" Again, "It is not difficult to refute the views of another, if we attribute to him false assertions which he has not made." Again, "That the mineral theory of Liebig is a pure invention of Mr. Lawes' might be clear to every one." Again, "My remark * * cannot be considered incorrect *because* Mr. Lawes has misunderstood its sense."

Leaving out of the question the work on "Chemistry in its Application to Agriculture and Physiology," in which Liebig now declares he did not teach the "mineral manure theory," let us see what he has written elsewhere, and also what others, besides Mr. Lawes, have taken to be his meaning. In a letter to the *Revue Scientifique et Industrielle*, Liebig says:

"In a short time I intend publishing a work which, I trust, will be interesting in the present state of agriculture. You are aware of the great importance which theoretical persons attach to the presence of ammonia in manures; so much so, that in France their value is estimated by the quantity of azote or ammonia they contain. For myself, for the last three years I have partaken of the common opinion, and regard the azote as not only useful but also necessary; but my last experiment, as well as careful observation, have lately compelled me to alter my opinion."

If we can understand language, Liebig here plainly states, that he formerly thought ammonia "not only useful but necessary," but that experiments and observation have compelled him to alter his opinion. In other words, he is now compelled to think ammonia neither necessary nor *useful* as a manure.

"It has been demonstrated," he continues "that ammonia is a constituent part of the atmosphere, and that as such it is directly accessible and absorbable by all plants. If, then, the other conditions necessary to the growth of the plants be satisfied—if the soil be suitable—if it contains a sufficient quantity of alkalies, phosphates, and sulphates, nothing will be wanting; the plants will derive their ammonia from the atmosphere, as they do carbonic acid. We know well that they are endowed with the faculty of assimilating those two aliments; and I really cannot see why we *should search for their presence in the manures we use.*"

In other words, if plants are supplied with their appropriate mineral food, they will obtain ammonia from the atmosphere, and we need not care to apply it in manure. The following sentence also indicates that Liebig considers ammonia unnecessary:

"The question of the necessity for ammonia in our manures resolves itself into the question of the necessity for animal manures, and upon the solution depends the entire future prospects of agriculture; for as soon as we can dispense with bulky farm-yard manure by the use of artificial preparations, the productive power of our fields is placed in our own hands."

In an article "On the Principles of Artificial Manuring," written at Geissen, in 1845, occur the following sentences:

"It results from this with certainty, that the mineral substances which are furnished by the soil, and which are found again in the ashes of plants, *are their true food*; that they are the conditions of vegetable life."

"The fertilizing power of manure can be determined by weight, as its effect is in *direct ratio to its amount in the mineral elements of the food of plants.*"

This is certainly explicit. The following argument is to the same effect:

"If these clements (the ashes of plants) are present in sufficient quantity and in appropriate proportions, the soil contains the conditions which render the plant capable of absorbing carbonic acid and ammonia from the air, which is an inexhaustible storehouse for them, and renders their elements capable of being assimilated by their organism."

"If we do not restore to a meadow the elements withdrawn, its fertility decreases. But its fertility remains unimpaired, with a due supply of animal excrements, fluid and solid, and it not only remains the same, but may be increased by a supply of mineral substances alone, such as remain after the combustion of ligneous plants and other vegetables, namely, *ashes*. Ashes represent the *whole* nourishment which vegetables receive from the soil. By furnishing them in sufficient quantities to our meadows, we give to the plants growing on them the power of condensing and absorbing carbon and nitrogen by their surface."

"Must not, we ask, the effect of the solid and fluid excrements, *which are the ashes of plants and grains burned* [the italics are Liebig's] in the bodies of animals and of man, be dependent upon the same cause? Must not the fertility resulting from their application be, to a certain extent,* independent of the ammonia they contain? Would not the effect be precisely the same in promoting the fertility of cultivated plants, if we had evaporated the urine and dried and burned the solid excrements before adding them to the soil? Surely the cerealia and leguminous plants which we cultivate must derive their carbon and nitrogen from the same source whence the graminea and leguminous plants of the meadow obtain them. No doubt can be entertained of their capability to do so." *Letters on Chemistry, last London edition, page* 514.

"Nothing can be more certain than the fact that an exportation of nitrogenized products does not exhaust the fertility of a country; inasmuch as it is *not the soil*, but the atmosphere, which furnishes its vegetation with nitrogen. It follows, consequently, that we cannot increase the fertility of our fields by a supply of nitrogenized products, or by *salts of ammonia alone*;† but rather that their produce *increases or diminishes in a direct ratio with the supply of mineral elements capable of assimilation.* * * * If we supply along with the ammonia all the conditions necessary for its assimilation, it ministers to the nourishment of the plants; but if this artificial supply of ammonia is not given, they can derive *all the required* nitrogen from the atmosphere."—*Ibid* 517.

*We are now quoting from the *last edition* of Liebig's Familiar Letters on Chemistry, published in 1851, subsequent to the publication of Mr. Lawes' results. *This qualifying clause was not in the former editions*, where the sentence reads "Should not the fertility resulting from their application be *altogether* independent of the ammonia they contain?"

†Here, again, this qualifying clause was not in the former editions, which read—"We cannot increase the fertility of our fields by a supply of nitrogenized *manure*, or by salt of ammonia." The change of the word *manure* to *products* is also significant.

These quotations require no comments. Mr. Lawes is severely censured for supposing that Liebig taught that theory which ascribes the effect and value of manures to the inorganic constituents of plants which they contain. Liebig thinks Mr. Lawes has read only one sentence of his book, and misunderstood that one. Let us see, therefore, what others have understood Liebig to mean.

Sullivan, in his *Manures of the Farm*, says: "The admixture of caustic lime with night soil has been objected to on the ground of the chemical decomposition which would thereby ensue, and the consequent evolution and waste of ammoniacal gas; but we have the high authority of Liebig for stating that the efficacy of human fœces as manure does not depend on their ammonia or nitrogen. Hence, in depriving night soil of smell, we do not diminish its value as a fertilizer." In other words, driving off the ammonia of manure does not decrease its fertilizing value.

Dr. Wessenborn, writing from Weimar to the London *Farmers' Magazine*, vol. 15, 373, says:

"*The great rule* of Prof. Liebig's new system of manuring is the following: Let the fields not be manured with stable dung, nor with any sort of dung whatever that contains organic (vegetable or animal) substances along with its organic (mineral) principles. This mineral manure the farmer has to procure either by incinerating all the vegetable substances that he has reaped, and which he cannot profitably sell or consume on his farm, especially by burning the straw; or by applying to a chemist with a view of having both he soil to be manured and the ashes of plants to be cultivated duly analysed, and of getting prepared, conformably to the result of such analyses, an artificial manure (mineral manure—manure of ashes) containing the very mineral food that the plant wants, and that is not already contained in the ground. * * * The farmer saves (by the new system of manuring) almost the whole of the expenditure for transporting manure to the fields, as the weight of the mineral manure he wants is only 26 per cent. of that of the stable dung hitherto used."

In one of his lectures, Mr. Karkeek adverted "to the doctrine recently introduced by Prof. Liebig, which under estimated the influence of organic manures in the soil and attached the more importance to the inorganic constituents of plants, by keeping a supply of which in the soil, he is of opinion that the carbon and nitrogen which are necessary for the growth of plants *will be supplied through the atmosphere.* This is a theory altogether opposed to the experiments which he (Mr. Karkeek) had placed before them that day, and it was also opposed to Liebig's previous teaching.'—*Far. Mag., vol.* xv. 260.

Prof. E. N. Horsford while with Prof. Liebig at Geissen, will be considered good authority in regard to the views of Liebig on this point. In a letter to Prof. Webster, dated Geissen, May 1, 1846, he says:

"You are aware that Boussingault has expressed the opinion, after a variety of experiments, that the value of manure is in near relation to its percentage of ammonia. Mulder has, you know, written much in support of the view that ulmic and humic acids, ulmates, humates, etc., in one form and another, minister largely to vegetation. * * Liebig differs from them all. * * He takes the position that the sources of carbon and nitrogen are carbonic acid and ammonia in the air. * * *

"It is obvious (from analysis of soils and rain-water) that the ammonia spread on fields in the ordinary distribution of barn-yard products *is of no moment*. The quantity with usual falls of rain *greatly exceeds, in the course of a season, any conceivable supply by human instrumentality*. * * *

Careful and numerous analyses of rain water and snow by Boussingault, Lawes, Way, and others prove beyond cavil, that "with usual [or unusual] falls of rain" no such quantity of ammonia is conveyed to the soil, as is here stated. We think that Prof. Horsford will now admit that "ten tons of ordinary barn-yard manure contain more ammonia than is carried to an acre of land in twelve months by usual falls of rain." This fact greatly weakens the force of Prof. Horsford's argument; but one object in quoting his remarks is not to attempt to point out where they conflict with more recent investigations, but simply to show that Mr. Lawes is not the only person who understood Liebig to teach "the mineral manure theory."

"But if in the manure heap and the liquid accumulations of the barn-yard, transported to the fields the ammonia be not the chief ingredient, or *an important one*, to what are we to attribute the unquestioned value of stable products and night soil? Prof. Liebig has shown that if plants be manured with the ashes of plants of the same species, as the grasses of our western country are when burned over in the fall, they are supplied with their natural food. * * Let us consider what these ashes are, and what manure is. Herbivirous animals derive their nourishment from the vegetable kingdom exclusively, their food being grass, grain, roots, etc. These, with their organic and inorganic matters are eaten. A portion of them is assimilated, becoming bone, muscle, tendon, fat, etc. Another portion is voided in the form of excrementitious matter. In process of time, the bones and tissue follow the same course. What to-day forms the eye, with its sulphur, and its phosphorous, and carbon, etc., will have accomplished its office, and left the organism to mingle with the excrements or escape as carbonic acid and water from the lungs. At length *all the inorganic matters will re-appear in the voided products*. * * The animal organism has performed the office of a mill. Grain was supplied. Instead of appearing as flour and bran and the intermediate meal, it appears after intervals of greater or less length, in soluble *inorganic salts* in the liquid excrements, in soluble *inorganic salts* in the solid excrements, and in carbonic acid and water. Now, after burning a plant, what remains? It contained when growing carbon, nitrogen, hydrogen, and oxygen, as organic bodies, and water. It contained also, in variable proportions, common salt, potash, soda, magnesia, lime, iron, phosphorous, sulphur, and silica. The first four were expelled in the combustion. The remaining ingredients, for the most part, remained unchanged. Had the plant gone into the body of an animal, and in the course of its evolutions through the organism lost its carbon, hydrogen, nitrogen, and oxygen, the remaining ingredients would have been the same as before. In one case the plant would have been burned in the organism; in the other, in a crucible. *The ashes and the excrements are substantially the same*. * * Night soil and guano are the *ashes* of animal and vegetable organism burned in animal bodies. They are the ashes of plants—the essential food of plants. *Hence their value as manures*."

We might multiply such quotations from our agricultural literature of the past decade *ad libitum*, but the above are sufficient to show that Lawes and Wolf are not alone in ascribing the "pure mineral theory to Liebig."

His pupils and followers, as well as those who differed with him, evidently understood Liebig as asserting that if the inorganic constituents or *ashes* of a given species of plants were supplied in sufficient quantity, and in proper condition, we should obtain a maximum yield; that the crops on a field increased or diminished as these mineral elements were supplied or withheld; that the mineral manure patented by Prof. Liebig, was an embodiment of his views; and that "sooner or later, they (farmers) must see that in this so-called 'mineral theory,' in its development and ultimate perfection, lie the whole future of agriculture."

Liebig, in his recent pamphlet, denies ever having entertained these views, and admits, very reluctantly, however, that Mr. Lawes' experiments prove them to be erroneous. He now says:

"I consider ammonia and its salts exceedingly useful, and indeed at present even, *perfectly indispensable* as a means of increasing the produce of our fields beyond a certain limit, without the use of stable manure."

Surely there is some difference between this sentence and the following one, which will be found in the first edition of Liebig's "Letters on Chemistry," but which has been altered in the subsequent edition, published since the appearance of Mr. Lawes' papers:

"It follows consequently, that we cannot increase the fertility of our fields by a supply of nitrogenized manure, or by salts of ammonia; but rather that their produce increases or diminishes, in a direct ratio with the supply of mineral elements capable of assimilation."

It is evident from these and other sentences which might be cited, that Liebig has changed his views in regard to the value of ammonia as a manure; but it is still very difficult to determine "what it really is that Liebig means." Perhaps he may accuse us, as he has Mr. Lawes, of having read but one sentence in his book, so we beg leave to state beforehand that we have read it over carefully several times, and that we are still in doubt as to the real position of the learned author on the subject it is the special object of the work to elucidate. He has made some "agricultural experiments" on a ten acre field, and in summing up his conclusions from them, says: "My experiments, which occasioned me an outlay of 8,000 florins, ($3,200,) or $320 per acre, show indeed that to make a soil fertile, which is barren from want of active (soluble) ingredients, and not on account of unfavorable physical condition, requires an outlay greater than the purchase of the most fruitful soil; but in this I was in no way disappointed. What I wished to arrive at, was well worth the sacrifice. What I have arrived at is, [now, surely, he will state his conclusions on the value of mineral manure; but alas, no! what he has arrived at is only] *the firm conviction that the time must come when agriculture will be carried on as an art, according to scientific principles, and not according to mere recipes.*"

Liebig brings forward these experiments as practical evidence of the correctness of his opinions, and they are, therefore, worthy of attention. He says:

"In the years 1845-9, I instituted a series of experiments on the action of individual mineral manures. * * Former experiments which I had made in my garden, gave no results; *do and apply what I would, I was not able to perceive any effect from a single one of my mixtures.*"*

The cause of this is ascribed to the richness of the garden soil. This led to purchase a ten acre field, "distinguished from all other land in the vicinity by its almost perfect incapacity to support the ordinary cultivated plants; I do not believe that in an entire year, so much grass and fodder grew upon it as would sustain a single sheep." This was, unquestionably, a poor soil; and the mind recalls instances of similar soils having been rendered fertile by the ordinary processes of agriculture. The farms of the late Judge Buel, and D. D. T. More, of Waterleit, N. Y., and many in the county of Norfolk, England, were once blowing sands, but now are as remarkable for fertility as they once were for barrenness. This result has been attained principally through growing crops of clover and turnips, by plowing them in, or consuming them on the farm, and returning the manure, thus supplying organic matter and especially ammonia, from the atmosphere. This, however, is simply a deduction from certain theoretical considerations, founded on Mr. Lawes' experiments; and we have frequently expressed the wish that experiments with ammonia salts, organic matter, and mineral substances, might be instituted on similar soils. By applying ammonia on one plot, organic matter on another, the various mineral manures on others, and a mixture of these in different quantities and proportions on others, and reserving one plot without any manure at all, we might obtain decisive information on this interesting subject. Let us see what kind of experiments the great Geissen Professor instituted.

*No part of the field was left without any manure.* A quantity of mineral manure was spread uniformly over the *whole field*, excepting a piece of vineyard of about 2000 vines, *each* of which received at the time of planting one quarter pound of the *same mineral manure.* "On separate divisions of the field were cultivated wheat, rye, barley, clover, potatoes, maize, beets, and Jerusalem artichokes." Would it not have been better, instead of having nine different crops and only one kind of mineral manure, to have had nine different manures, and only one crop? If the ashes of plants represent the manure best adapted for their growth, no one compound of mineral manures could be best suited to both wheat and clover, maize and beets.

"Some patches received saw-dust, one nothing but stable-manure, another a mixture of the mineral manure with an equal quantity of stable-dung. Beside this stable-dung, no other animal substance no ammoniacal manure was used on the whole field. One small plot had added to it several waggon loads of soil from a forest; another received the same, mixed with the mineral manure."

*Prof. HORSFORD, in one of his letters from Geissen, (*Cultivator*, 1846, page 139,) alludes to these experiments as follows: "In the spring, (1844,) preceding my arrival in Geissen, the Professor planted some grape scions under the windows of the laboratory. He fed them, if I may use such an expression, upon the *ashes of the grape vine*, or upon the proper inorganic food of the grape, as shown by analysis of its ashes. The growth has been enormous, &c. I was shown pots of wheat, in different stages of their growth, that had been fed variously—some upon the inorganic matters they needed *according to the analysis of their ashes*—others had merely shared the tribute of the general soil. The results in numbers I don't yet know. In appearance, no one could be at a loss to judge of what might be expected. * * The [experiments of Prof. L., which I have alluded to, are full of interest not alone as sustaining the views he has expounded, [what views, if not those of the mineral theory?] but as also showing that the treasures in the shade of inorganic manures, heaped up in some quarters of the globe, may be made to equalize the fruits of labor in other regions."

In other words, the *whole field* was dressed with the *same mineral manure*. Some plots had stable-dung, and some forest soil with and without an additional quantity of the *same mineral manure*. No purely ammoniacal matter was used. The poor impoverished soils of Maryland, Virginia, &c., have been made to yield an excellent crop by the application of a small quantity of ammoniacal guano.

Who knows whether such would not have been the case with "Liebig's Heights?" Certainly, in instituting scientific experiments, there could have been no harm in trying.

"The crops the first year," says Liebig, "turned out so moderate, so bad, in fact," that no details are given. The yield of turnips, clover and potatoes, did not suffice for keeping one cow. In every case, however, where organic manures containing ammonia were used, the crops "were heavier than elsewhere." The wheat manured with "stable dung and minerals was equal to any in the neighborhood." Why not have tried a plot with stable dung, without any minerals?

It must be evident to all that the first year's results of Liebig's experiments are strongly in favour of organic or ammoniacal manures. We are told that in the second, third, and fourth years the soil increased in productiveness, though no details at all are given. In 1849, Liebig's gardener "purchased the whole field, and the industrious man, who could not afford to buy manure, manages with profit the now well-conditioned little farm; assisted, during the summer months, by a little business, in selling refreshments, he is able to support himself and family, keeping two cows, and annually raising several head of cattle; and he has acquired enough to enable him to enlarge his buildings; and all this without ammonia or humus, and only by help of mineral manures."

This is certainly a very gratifying result. After expending on ten acres of land $3,200 for mineral manures, &c., an industrious Dutchman, by the aid of a little business, in which probably his wife and children engaged, was enabled to support himself; and all this without the aid of ammonia! Was it ever heard before that a man could get a living from ten acres of land, in close proximity to a large city? But let us see whether this was accomplished without the aid of ammonia. The forest muck, saw-dust, and stable-manure used the first year, all contained ammonia, and the crops *were much the best where they were used*. Liebig says:

"Since the present owner came into possession, the stable-manure and all the animal excrements produced on the premises, *and especially the urine*, have been collected with the greatest care, and of course have been incorporated with the soil."

In other words, great care has been used to save all the *ammonia* and incorporate it with the soil, and fair crops, after a period of eight years, have rewarded the care and skill of the cultivator. Who knows but this same result might have been attained in one year, by an application of ammonia? If the atmosphere is capable of supplying all the ammonia that plants require, why was it found necessary on this field, which had been so lavishly dressed with all the mineral elements of plants, to save all the dung and "*especially the urine*," and incorporate them with the soil! Surely, the gardener evidenced little faith in the teachings of his great master! If these experiments prove anything, it is the very reverse of what Liebig intended they should prove; and they are the only experiments brought forward to sustain his position.

After disparaging Mr. Lawes' experiments Liebig says:

"*The single problem worthy of scientific agriculture* at the present time, is to establish in place of a change of crops, a change or succession of manures, which shall enable the farmer to grow on his fields that crop, which, under the circumstances, will be most profitable. How simple a form would the labors of a farm assume, could he continuously cultivate the same plant on the same field."

This is certainly a good idea, though an old one; but how shall we ascertain what manures are best adapted for the same crops? Liebig himself took out a patent for "a preparation of compounds, *based upon analysis of plants*, which were estimated to provide a given species of plants with a nourishment it would need throughout a series of years." That these compounds utterly failed in Germany, England, and America, is notorious. The idea was a splendid deduction, but, unfortunately for the farmer, so far from revolutionizing agriculture, as was predicted, it proved what might have been foreseen, that deduction is not a safe guide in scientific agriculture. We shall probably incur Liebig's displeasure by referring to this unfortunate manure speculation. He has brought forward a number of sentences from his various works to show that he did not teach "the pure mineral theory;" but this patent mineral manure, which is a practical embodiment of the theory, is not so easily disposed of; hence the bitterness manifested on the subject.

Liebig's patent mineral manures have confessedly failed to solve "the single problem worthy of scientific agriculture." We cannot, by their use, "continuously cultivate the same plant on the same field." Now, though Mr. Lawes does not think it desirable to cultivate the same crops on the same land, he has succeeded in doing so to an extent which one would suppose from the above sentence, should have secured the approbation of the great German chemist. There is now growing on *Broadback** the *twelfth annual wheat crop*, and the crop of last year, (1854,) was the largest yet harvested from it; one plot yielding 55 bushels of wheat per acre. So with the turnips on *Barnfield*; the *thirteenth* annual crop is now growing, and though the soil is rather too heavy to be well adapted for turnip culture, yet good crops are obtained, fully equal, as we know from our own observation, to those grown in the neighborhood, under the ordinary system of rotation. So in *Geescroft*, twelve crops of beans have been grown in twelve years, and removed from the soil, and yet as good crops are obtained as the farmers could desire. So of peas and tares. Clover is an exception; no matter how lavishly and variously it is manured, clover will not flourish continually on the same land. But with other crops, Mr. Lawes has "solved the single problem worthy of scientific agriculture." At the present price of wheat and ammonia, Mr. Lawes or any other intelligent agriculturist, can not only grow wheat continuously on the same land, but can also *grow it with a profit*. If his land, without manure, will produce 15 bushels of wheat per acre, he can make it produce 30 bushels by an application of from $12 to $15 worth of manure. If wheat sells for 80 cents to $1 per bushel, such a system will not pay; if it is worth from $2 to $3 per bushel, noththing can be more profitable.

Liebig says:

"So to explain the action, and recommend the use of ammonia salts in the production of wheat, as Mr. Lawes has done, appears to be mockery of the present state of agriculture; for all the salts now manufactured in Europe, are not enough to supply the fields of the kingdom of Saxony with the quantities used by Mr. Lawes."

This appears to us a very lame argument. What if salts of ammonia are not now manufactured in sufficient quantities? If farmers can obtain what they want at present, shall they not use them? The ammonia salts used in agriculture or commerce, are made principally from the refuse liquor of the gas works; and in nearly every city in Europe the greater portion of this liquor runs to waste. In this country, we know of but one establishment where ammonia salts are manufactured from gas liquor for agricultural purposes. Shall we condemn the use of ammonia salts, because they are not at present extensively manufactured, while we have the means of increasing their production to an almost unlimited extent?

But Mr. Lawes has not "recommended the use of ammonia salts in the production of wheat." Mr. Lawes tells us, indeed, that ammonia is specially needed for the production of wheat; but he has never advised farmers to use ammonia salts at their present price. He used them in his experiments because they enabled him, for a special object, to apply ammonia free from the organic and mineral matter united with it in barn-yard manure, guano, rape cake, &c. These experiments led him to the conviction that ammonia, in ordinary agriculture, is greatly needed on all our wheat soils, but he has never recommended farmers to imitate his example, and purchase expensive ammonia salts. He points to cheaper sources of it. What these sources are, we shall see further on.

Professor Liebig, in some parts of his late work, appears to labor under the impression that Mr. Lawes affirms that if ammonia be present in sufficient quantity in the soil, the wheat plant can grow *without minerals*. We cannot understand how any one could arrive at such a conclusion from Mr. Lawes' writings. Certainly he has never written any thing which favors such an idea; while he has repeatedly declared that the "growing plant must have within its reach a sufficiency of the mineral constituents of which it is to be built up." He also fully admits that the atmosphere and rain-water are capable of supplying plants with a considerable quantity of ammonia. On these two main points, Liebig and Lawes are agreed. In what, then, do they differ? It is obvious that they do differ very essentially, but in what exact particulars, it is hard to say, simply because it is impossible to determine what Liebig at present teaches. From the general tenor of his works, we conclude that he believes, or did believe among other things, that the manurial requirements of a plant are represented by its ashes. In other words, that the *proportion* in which potash, phosphoric acid, &c., exist in the ashes of a plant, is the best *proportion* for them to exist in the manure adapted for their growth. The ash of wheat contains 50 per cent. of phosphoric acid, that of turnips only 10 per cent.; therefore, a manure for wheat should contain five times as much phosphoric acid as a manure for turnips. That Liebig and his followers have taught the

* *Broadback* is the name of Mr Lawes' experimental wheatfield. All the fields in England are named. *Barnfield*, *Geescroft*, *Hoosfield*, are the names of the experimental turnip, bean, pea, tare, and clover fields.

doctrine, cannot be denied. Mr. Lawes' experiments prove this idea erroneous.

Liebig, we have shown, taught that if plants are supplied with a sufficient quantity of their ash constituents, they will obtain all the ammonia they need from the atmosphere. Mr. Lawes' experiments show this partly right, and mostly wrong. They show that wheat, which contains only a comparatively small quantity of nitrogen, (ammonia,) requires for a maximum crop, very much more ammonia than the atmosphere and rain can supply under the most favorable conditions. On the other hand, they show that beans, peas, tares, and turnips, which contain much more nitrogen than wheat, are enabled to obtain nearly all the nitrogen and ammonia they require, from the atmosphere and rain-water. Mr. Lawes thinks it not improbable that the other cereals commonly cultivated require, like wheat, a much larger quantity of ammonia for their maximum growth than they can obtain from rain and air; and that, as these generally command a high price, and farmers wish to raise them as frequently as possible, every available means should be used to increase the supply of ammonia on the farm. But, as Liebig denies that these experiments lead to any such conclusions, let us briefly glance at the principal results obtained.

Three fields, with the general character of the soil and previous treatment as much alike as possible, were set apart for these experiments, some 17 years ago. Four crops were grown without any manure, and removed from the fields before the experiments proper commenced. One or more plots in each field were always left without any manure, and the others received a variety of the various organic and inorganic fertilizing substances. The first year, on the wheat field,

The unmanured plot yielded 16 bushels per acre.

14 Tons farm-yard manure, on a plot adjoining, 22 bushels.

The *ashes* of 14 tons farm-yard manure, 16 bushels.

Mean of 9 plots, dressed with artificial *mineral manures*, 16¼ bushels.

Mean of 3 plots with artificial mineral manures, and 65 lbs *each of sulphate of ammonia*, 21 bushels per acre.

With turnips, the first year, the unmanured plot gave 4 1-5 tons of bulbs per acre.

12 Tons farm-yard manure, 9½ tons.

56 Pounds sulphate of ammonia, less than 7 tons.

4½ cwt. superphosphate of lime, 12¼ tons.

From these few experiments, which we select from a large number giving similar results, it will be seen that even the first year shows a great difference between the manurial requirements of the wheat and turnips. On wheat, a heavy dressing of superphosphate of lime, phosphates of magnesia and potash, and silicate of potash, gave an increase over the unmanured plot of only three pecks per acre; while on turnips, the superphosphate of lime *trebled the crop.* The 56 lbs. of sulphate of ammonia per acre, which had such a good effect on wheat, had little effect on turnips, giving only about half as large a crop as the superphosphate of lime.

The second year, *the same* unmanured wheat plot gave 23 bushels per acre.

14 tons farm-yard manure, 32 bushels; and 168 lbs. each of sulphate and muriate of ammonia, 33¼ bushels.

One plot, which received the previous year superphosphate of lime without benefit, was this year left without any manure, and the yield was 22½ bushels, or half a bushel *less* than the plot continuously unmanured.

The same unmanured plot the second year, on turnips, produced 2 1-5 tons of bulbs per acre.

5 cwt. superphosphate of lime, 8¾ tons.

4 cwt. superphosphate of lime, with 56 lbs. *sulphate of ammonia*, 5½ tons.

It is remarkable that while on the unmanured wheat plot the second year, the yield was 23 bushels, the crop on the unmanured turnip plot was only 2 1-5 tons of bulbs per acre; and while sulphate of ammonia is again so beneficial on wheat, it has no influence on turnips; on the other hand, superphosphate of lime which is attended with little or no increase on wheat, gives a great increase of turnips—four times as much as the unmanured plot!

The third year the same continuously unmanured plot yielded 17¾ bushels per acre.

On another plot, from which, the previous year, a large crop was taken by the use of ammonia salts, but which was this year left unmanured, the yield was a little over 17½ bushels.

This is again nearly identical with the plot continuously unmanured, and shows conclusively that the ammonia *is all assimilated the first year.* Does it not, also, on the other hand, discountenance the popular notion that ammonia is a *stimulant*, acting on the plant as alcohol on the animal organism?

224 lbs. sulphate of ammonia alone, gave 27¼ bushels.

The ash of 3 loads of wheat straw gave 19 bushels.

The ash of 3 loads of wheat straw and 224 lbs. sulphate of ammonia, 27 bushels, nearly identical with the yield obtained from the same amount of ammonia alone.

448 lbs. of Liebig's wheat manure gave 20¼ bushels.

448 lbs. of Liebig's wheat manure, and 112 lbs. each of sulphate and muriate of ammonia, gave 29 bushels.

14 tons farm-yard manure gave 27¾ bushels, or precisely the same amount as that obtained from 2 cwt. of ammonia salts alone.

The third year, the same unmanured turnip plot produced only 13½ cwt. of bulbs per acre.

6 cwt. of *sulphate of ammonia*, 3½ tons.

534 lbs. superphosphate of lime, nearly 13 tons.

3 cwt. of sulphate of ammonia, in addition to the same amount of superphosphate, gave no more, but rather less, than the superphosphate alone.

11 cwt. of superphosphate of lime gave 14½ tons.

The same amount of superphosphate, with 3 cwt. of sulphate of ammonia in addition, gave 14 tons and a half.

We may here remark—and we call particular attention to it, as showing that it is the phosphoric, and not the sulphuric acid, to which superphosphate of lime owes its efficacy as a manure for turnips—that 12 cwt. of sulphate of lime gave less than 5¾ tons; and the same amount of sulphate of lime, with 3 cwt. of sulphate of ammonia in addition, gave only 4¾ tons, while superphosphate, with and without ammonia, gives 14½ tons.

We might extract from these extensive and long continued experiments many more similar results for other years, but surely we have given enough to show that so far as applied to wheat, the mineral theory, as taught in the extracts we have given from Liebig and his followers, is at fault; and also that for turnips, while the rain and atmosphere are capable of supplying to a great extent the ammonia they require, and that it is partly true that the crop "increases or diminishes in a direct ratio with the supply of mineral elements capable of assimilation;" yet it is evident that the proportion in which mineral elements are required, are precisely the opposite of what the analysis of the ashes of the turnip would lead us to expect.*

* Our limited space has compelled us to leave out the results of repeated applications (of potash,) of which the turnip ash contains some 40 per cent.,) soda, magnesia, &c., but we may remark that they were attended with little or no benefit.

The experiments in *Geescroft*, on beans, peas, and tares, show that these plants, which contain such a large amount of nitrogen, are benefited little if any by an application of ammonia or nitrogen. The same, to a certain extent may be said of clover. There is evidently great difference in the manurial requirements of wheat, and probably of the other cereals, and those of turnips, beans, peas, tares, and clover. The mineral theory of Liebig, indeed, points out a difference, but it is the *very reverse* of what the above experiments and others which might be brought forward, show to be the case.

Liebig claims these experiments as a practical confirmation of his theory; and by suppressing some of the principal facts, mistaking others, and seizing on one or two results that are manifest exceptions to the general indications of the experiments, and by a series of ingenious special pleadings, he endeavors so to twist the results as to make them sanction the mineral theory. Let us examine the arguments of the great chemist.

From the facts that the unmanured wheat plot yields annually about 18 bushels of wheat per acre; that the addition of a great variety of mineral manures gives little or no increase; and that the addition of ammonia alone gives a great increase, we had concluded that this field *contained an abundance of all the mineral elements of plants* capable of assimilation, and that the reason why it produced 18 bushels per acre, instead of 28, as when ammonia was used, was to be attributed to a lack of ammonia. In other words, that wheat on this soil, cultivated after the most approved methods, hand-hoed thrice in the spring, *abounding in all the mineral elements of plants*, was not able to *obtain sufficient ammonia* from the atmosphere for a maximum crop. Were this admitted, the dearly cherished mineral theory must be given up; and Liebig, therefore, endeavors to prove that the reason why 18 bushels per acre only were obtained, is attributable to a deficiency of available minerals. He asserts that the cause of the beneficial effect of the sulphate of ammonia is due to its *solvent* action on the phosphates of the soil; and that it simply or principally acted by rendering an increased amount of the mineral elements of the soil capable of assimilation.

We would ask, in reply, if maximum wheat crops were not obtained from lack of soluble phosphates, &c., why it was that an application of soluble phosphates, &c., did not increase the crop? They were used in various forms and proportions, without stint, yet they gave no increase, and Liebig's own patent wheat manure failed. If, moreover, sulphate of ammonia acts merely as a solvent of phosphates, &c., how does it happen that the large amount used on some of the turnip plots is attended with little or no increase, while soluble phosphates artificially applied, give an astonishing increase.

It is impossible to answer these questions, and accordingly Liebig endeavors to show that the increase of turnips, from an application of superphosphate of lime, is not due to the soluble phosphate of lime which it contains, but to the sulphate of lime necessarily associated with it.

English farmers will be glad to learn that it is simply the sulphate of lime the superphosphate contains that benefits their turnip crop, and that they can obtain the same effect very much cheaper from gypsum or plaster. We have no doubt that half a million dollars worth of superphosphate was applied to the turnip crop of England last year, the greater portion of which might have been saved by a knowledge of the fact discovered by Professor Liebig!!

Some will ask on what evidence our author bases this opinion. We answer, on one solitary result, taken from Mr. Lawes' experiments—a result in direct contradiction to the general indications of the investigation, and in opposition to the results of other experiments on turnips, with superphosphate, sulphate of lime and sulphuric acid—a result, in short, which is *simply a typographical mistake.*—Liebig says:

"A like plot in 1845, which received 12 cwt. of gypsum, (residue from the preparation of tartaric acid,) and 10 cwt. of rape-cake, yielded 18 tons, 1 cwt. of turnips, *six tons more* than those fields on which phosphoric acid was employed. * * What strange results do these facts offer,—in what incomprehensible contradiction do they stand to the views of Mr. Lawes."

On referring to our copy of Mr. Lawes' paper, we found a marginal note, made years ago, stating that the 18 tons, 1 cwt., should be 10 tons, 1 cwt. It is much to be regretted that this mistake was not marked in the copy sent Professor Liebig; or that he did not discover the error, as he might have done by referring to the tables on the two following pages. Few will be surprised, considering the immense amount of tabulation in Mr. Lawes' papers, that a printer, should in one instance, place an 8 instead of a 10, but it will astonish many to find that on this *single mistake*, Liebig should adopt a view which is not only opposed to the general indications of the whole series of experiments, but is also at variance with the experience of every farmer who has used superphosphate of lime and sulphate of lime of lime as a manure for turnips.

This error corrected, the opinion based upon it falls to the ground, and with it the idea that the beneficial effect of sulphate of ammonia on wheat is due to its rendering the phosphates of the soil soluble. Soluble phosphates greatly increased the turnip crop, but the *same soluble phosphates*, on similar soil, did not increase the wheat crop; sulphate of ammonia did not increase the turnip crop, but did greatly increase the wheat crop; therefore sulphate of ammonia does not act simply in furnishing to the wheat plants soluble phosphates.

Mr. Lawes repeatedly alludes in his papers to the fact that though the increase of wheat over the unmanured plot was in pretty direct ratio to the quantity of ammonia applied to the soil, yet that the increase was never so great as theoretical considerations would lead us to suppose. Thus, estimating a bushel of wheat and its proportion of straw, to contain a pound of nitrogen, it might be supposed that if nitrogen was wanted, a pound of nitrogen, applied in soluble ammonia salt, would give an extra bushel of wheat; but this is not the case. Without making any pretensions to settle the *exact* amount, Mr. Lawes estimates, from the immense number of instances in which ammonia has been used, in various ways and proportions, in his experiments, that five times as much nitrogen, in the form of ammonia, is required to produce a bushel of wheat, as it contains when grown. This estimate has stood the test of many trials, and is in accordance with the well-ascertained effects of Peruvian guano on wheat. Mr. Lawes founds on this fact some very important practical suggestions, but which we cannot at this time refer to. Liebig *takes no notice of this opinion*, and refers to the loss of ammonia in these experiments, as though it had escaped the attention of Mr. Lawes, and as though he were the first to point it out. and he proceeds to show that the increase "bears no relation whatever" to the ammonia added to the soil. This is proving far too much, even for Liebig's own theory of the action of ammonia as a solvent; but let that pass. The method Liebig adopts to get at this result, is as follows: 60 lbs. of ammonia, say, give in 1844, an increase on the unmanured plot of 10 bushels. This increase contains only 15 lbs. of ammonia, and therefore Liebig estimates that "*beyond all doubt*," 45 lbs. of ammonia are left in the soil for the next crop. In 1845, 60 lbs. of ammonia again give an increase of 10 bushels; but Liebig adds to this the 45 lbs. which he assumes remain in the soil from the previous year, making 105 lbs.; and in this way he proceeds, adding the ammonia he supposes to remain in the soil to that applied each year, and from the figures obtained proves that the increase bears no proportion to the supply of ammonia! We believe this method of estimating the action of ammonia fundamentally erroneous. Certainly we do not know of a single result, in these or any other experiments, that shows the ammonia of soluble salts to remain in the soil over one year, when wheat is grown, and when sufficient minerals are present to enable the plants to take up all the ammonia they require. Let us suppose a case, and one which is clearly deducible from the experiments. The continuously unmanured plot gives 15 bushels of wheat per acre; a plot adjoining, dressed with 30 lbs. of ammonia, gives 20 bushels per acre; another lot, dressed with 60 lbs. of ammonia, gives 25 bushels; another, dressed with 90 lbs., gives 30 bushels; and another, receiving 120 lbs., 35 bushels per acre. The next year, all these plots receive no manure, and the produce is the same on each, neither more nor less than that from the continuously unmanured plot. What deductions should we make from such facts? According to Liebig's view, the first plot would contain, the second year, no ammonia; the second plot would contain 24 lbs. of ammonia; the third, 48 lbs.; the fourth, 72 lbs.; and the fifth, 96 lbs. of ammonia per acre. Now, if this be true, surely the produce would not be alike on all the plots! A direct application of ammonia has always given a definite increase, and we cannot see why the ammonia remaining in the soil from the previous year should not also give an increased yield. The fact that it does not is clearly established, not only by these experiments, but by the experience of hundreds of practical farmers, who have used salts of ammonia, Peruvian guano, &c.; and we feel warranted in concluding from these facts, that ammonia is all used up the first year—unless Liebig, or those who agree with him on this point, can bring forward better argument to the contrary, than the simple, unsustained assertion that it is "perfectly impossible."

Is it not more consistent with the facts of the case to suppose that the ammonia, being quite soluble, is all taken up the first year; and that in the growth of wheat there is, for some purpose or other, *a great destruction of ammonia?* It is well known that plants give off oxygen, and in the absence of light, carbonic acid; why may they not also give off ammonia? Chemists have always had a difficulty in accounting for the manner in which silica is deposited on the straw of the wheat plant. Prof. Way has shown that ammonia and silica, in certain double salts, form slightly soluble compounds, and he suggested that in this form the silica and ammonia is taken up into the plant; and that when the silica is deposited, the ammonia evaporates into the air. Our object is not here to decide whether this be so or not; we wish merely to show that Liebig has no right to assume, as he has done, that it is "perfectly impossible" for plants to take up more ammonia than they contain when grown, and found all argument on the assumption. He would have shown a better spirit, had he met the views of Mr. Lawes and Prof. Way on this point with some argument, rather than by ignoring them altogether, and reasoning as though nothing had been said in regard to it.

The whole question appears to us to turn on this very subject, which Liebig has entirely overlooked in his review of Lawes' experiments. If it be true that wheat and the other cereal grasses need for their production a much larger quantity of ammonia than they contain when grown, and if, on the other hand, turnips, beans, peas, tares and clover do not, we have at once an explanation of those gradually developed systems of rotation which an enlightened experience has proved judicious. We see at once why two grain crops should not follow each other; why clover and peas and beans are the best crops to precede wheat, and why the turnip, in the Norfolk system of British agriculture, is such an excellent crop to precede barley. Indeed, we do not know of one solitary well-established fact that is opposed to this view; and surely, if it be correct, nothing can be more important to a correct understanding of rational agriculture. It is true, that it points to no revolution in our present system of culture, and in this respect will be less acceptable to all ultra reformers; but it explains the rationale of the most approved systems of rotation and general farm management, confirms what practical farmers have previously but indistinctly perceived, and urges them to carry out still further, and by more economical methods, a system of improved culture they have already commenced.

In Germany Liebig's pamphlet has produced considerable excitement. Dr. Wolff, Professor of Chemistry in the celebrated Hohenheim Academy of Agriculture and Forest Culture, and a man who, in the language of Mr. S. W. Johnson, of Yale College, unites "eminent scientific ability with practical knowledge," has written a masterly reply to Liebig, and enters warmly into the defence of Messrs. Lawes & Gilbert, whose scientific reputation the great advocate of the "mineral theory" has savagely assailed. This has called forth another paper from Prof. Liebig, and which has been translated by Mr. S. W. Johnson, and will be found in the "Country Gentleman," (Oct. 11, Nov. 8). The greater portion of it has only a remote bearing upon the subject under discussion. Prof. Liebig appears to avoid, as much as possible, the real issues of the question. When the result of any of Mr. Lawes' experiments throw doubt on Liebig's views, he cries out, "Must not every farmer see that conclusions founded upon experiments conducted in a manner so rough, so utterly lacking circumspection, are *utterly* valueless!" But when any of the results of these same experiments confirm any of Liebig's opinions, he tells us, "The facts which he" (Mr. Lawes) "has ascertained, teach so many important doctrines in reference to the cultivation and manuring of the soil, that I hold them to be of very special value to the theory of agriculture." And in another place he says of these "*utterly valueless*" experiments, "It must be acknowledged, what I said at first, that of all the investigations that have been made, none are so eminently adapted as his" (Mr Lawes') "to advance the mineral theory." "Mr. Lawes' experiments thus *demonstrate*"—"The trials of Lawes confirm this view"—"Mr. Lawes has *proved*"—"But the experiments of Mr. Lawes furnish perfectly definite and *reliable* facts relative to this subject"—"The results of Mr. Lawes demonstrate precisely"—"From the result of Mr. Lawes it is perfectly certain"—&c. &c.

To us it is "perfectly certain" that the same experiments cannot be "*utterly valueless*" and of "very *special value*," and we are quite unable to understand how "experiments conducted in a manner so rough, so utterly devoid of circumspection," can "demonstrate," or "prove," or "disprove," or render "perfectly certain" anything at all; and yet "of all the investigations that have been made, none are so eminently adapted to advance the *mineral theory*." "Indeed," exclaims Liebig, in another place, "I consider them the *firmest support* of the theory." This is proving too much. The mineral theory is confessedly a deduction, and the inductive experiments which are its firmest support are "utterly valueless."

But to the question. As we have said, Mr. Lawes found a definite increase of wheat from an application of ammonia to a soil abounding in all the mineral elements of plants. But under the most favorable circumstances he has never obtained as much nitrogen in the increase of grain and straw as was supplied to the soil in manure. He concludes from this, that in the growth of wheat there is a great loss of ammonia. Without attempting to determine the exact proportion, he states that his experiments indicate that for one pound of nitrogen (ammonia) organized in the wheat plant, five pounds are evaporated into the atmosphere, and are lost to the farm. On the other hand, his experiments with turnips, clover, beans, peas, and tares, prove that in the growth of these so-called "fallow crops," no such loss takes place. Liebig, as has been stated, took no notice of these views of Mr. Lawes, but Dr. Wolff has forced them upon his attention; and in his reply to Dr. Wolff Liebig alludes to them as follows:

"In the writings of experienced agriculturists, I find as quite a general rule, that they do not hold a field rich in ammonia (freshly dunged) to be especially adapted for the cultivation of wheat, but recommend some other crop (potatoes) to precede wheat on such soils.

"But the experiments of Mr. Lawes furnish perfectly definite and reliable facts relative to this subject. He has found that a field which had previously received no ammonia nor ammonia salts, can yield a medium harvest of 1125 lbs. wheat and 17.56 cwt. straw for seven years in succession, without any artificial supply of ammonia, and in the last years the yield was greater than at first.

"From this it is perfectly certain that a soil, otherwise good, will yield almost an average crop of wheat without an addition or excess of ammonia; and that, no matter what quantity of ammonia may have been contained in the soil originally, and given up to the plant, or lost, this loss was without effect on the crops of the succeeding years.

"It is therefore allowable to pronounce the assertions of Dr. Wolff—that wheat requires for perfect development more ammonia than the soil contains in natural form—that the soil suffers a loss of ammonia by the cultivation of wheat, becoming in consequence less fertile—are wanting all foundation in fact, because the results of Mr. Lawes demonstrate precisely the contrary. * * The erroneous assertion of Dr. Wolff rests equally upon the erroneous interpretation which Mr. Lawes has given of the fact that ammonia salts increased the yield of his wheat field.

"While Mr. Lawes harvested 17 bushels wheat and 17½ cwt. straw from one acre of unmanured field annually for seven years, a plot of equal size and quality, which received in the first year 5 cwt. of dissolved bones, and 2 cwt. of silicate of potash, and in the following six years 326 lbs of ammonia salts (the average) annually, yielded 25 bushels, or a yearly increase of 8 bushels of wheat, and a corresponding larger produce of straw.

"Now, since this plot, as a part of the same experimental field, would undoubtedly have grown 17 bushels without any manure, he ascribed the increase to the action of the ammonia salts, without taking any account of what had been added the first year.

"Further, since in order to produce one bushel more of wheat than the unmanured plot would have yielded, Mr. Lawes added 41½ lbs. of ammonia salt; and since one bushel of wheat contains 1.2 lbs. of nitrogen, and 42½ lbs. of ammonia salts contain 6½ lbs. of nitrogen, he harvested in the grain and straw five times less ammonia than he added to the soil. This is the fact. The false conclusion that he deduces is, that the culture of wheat is accompanied by an enormous loss of ammonia, since, at the lowest estimate, 5 lbs. of ammonia must be added to the soil in order to get one bushel of *increase* per acre.

"In order to draw a general conclusion from the observed fact, i. e., to be able to speak of it as a matter of settled experience, Mr. Lawes should have determined, in accordance with the rules of research, the general conditions which determine the production of one bushel of wheat and the corresponding amount of straw *in all* *cases*, as well as the special conditions which caused the increase in his experiments.

If now it is true that 6 lbs. of ammonia were necessary to produce one bushel of *extra yield*, and that of this ammonia 5 lbs. were lost (evaporated through the plant), it must also be true that 6 lbs. of ammonia were removed from the soil of the unmanured plot, to produce every bushel of *ordinary yield*, and of this ammonia 5 lbs. also were lost to the soil by volatilization.

"Since now the unmanured plot yielded in seven years 123¾ bushels of wheat, it follows that the soil must have contained, or received from the air or rains, 618¾ lbs. of pure ammonia, or 3850 lbs. of carbonate of ammonia (salts of hartshorn), and that in seven years this quantity of ammonia was rendered useless for future harvests by the wheat culture.

"Such a conclusion it is impossible to support by any fact. What we know with certainty is, that during seven years 21¼ lbs. of nitrogen were annually removed from the soil of the unmanured plot by the crop grown upon it, or 149 lbs. in total. But how much ammonia was contained in the soil, and was consumed in the production of 17¾ bushels of wheat, we know nothing about.

"Since, now, Mr. Lawes did not know how much ammonia the wheat plant requires from the soil in order to give one bushel of yield upon the unmanured plot, how could he know that for every bushel of increased yield (gain by manuring) precisely six pounds of ammonia were necessary?

"If it had accidentally occurred to Mr. Lawes to manure his field with four, five, or six cwt. of ammonia salts, instead of with 3¼ cwt., and if in those cases the yield was not increased (as we may with certainty assume would happen) then he might with the same justice assert that the loss of ammonia is 6, 8, or 10 lbs. for every bushel of increased yield.

"Or if Mr. Lawes had applied ammonia salts at the rate of 2 or 1 cwt. instead of 3¼ cwt. the acre, and then, after previous manuring with dissolved bones and silicate of potash (whose action he has not taken at all into account), had harvested the same increase of 8 bushels, his conclusion that the soil suffers a loss of ammonia would doubtless have been vastly modified. He has made the loss and not found it. The number 5 for the amount of ammonia, and the quantity 1 bushel for the increased yield, are not expressions for a natural relation between manure and crops. The first does not express the weight of ammonia necessary to produce a maximum of increase equal to 1, and ascertained by a series of observations, but is a mere stroke of fancy. It never seems to have occurred to Mr. Lawes to determine the minimum of ammonia which was effective upon his field in producing maximum crops."

The pith of the controversy lies here; and Liebig puts forth his whole strength. We have rarely met with a finer specimen of special pleading. It is, however, the only portion of his lengthy paper which is to the point. The case against Mr. Lawes is stated in as strong a light as possible, and no doubt many who read only one side, will be deceived by the plausible sophistries of this greatest, ablest, and, we are sorry to add, most unscrupulous of controversialists. He seems to "stick at nothing" that will help him to make out a case. Nevertheless, we are glad that Dr. Wolff has succeeded in forcing him to attack Mr. Lawes' main position. We have given Liebig's whole argument, and will now briefly examine it.

It is true, as Liebig states, that Mr. Lawes' soil yielded 17 bushels of wheat per acre annually for seven years, without any manure; and we may add, indeed, for thirteen years. It is also true that mineral manures—the ashes of the wheat plant—alone, do not enable it to produce any larger crop. It is further true that 17 bushels "is almost an average crop of wheat." On the other hand, it is also true that where this same soil has been annually supplied with ammonia *alone*, much larger crops have been obtained—on an average of seven years, as Liebig admits, *half as much again*; and, we may add, last year (1854) as much as 34½ bushels per acre were obtained; and this, it must be observed, after ten successive crops had been grown (and removed from the soil) by the aid of ammonia alone. The province of Agricultural Chemistry, Liebig tells us, is to produce *more* grain and *more* meat, and not simply grain and meat, which have been produced for centuries without her aid. We fully agree to this; the object of agriculture is not to maintain merely, but to *increase* the productiveness of our fields. How can this be done? Liebig says truly that the 17 bushels of wheat annually grown on Mr. Lawes' experimental field, by the aid of good tillage alone, is "almost an average crop." But the object of Agricultural Chemistry, according to Liebig, is to *increase* the productiveness of our fields. This Mr Lawes has done. Instead of 15 or 20 bushels of wheat per acre, he has grown 30 and 40 bushels, and in 1854 as high as 55 bushels; and, in a private letter recently received, Mr. Lawes informs us that some of the plots this year (1855) *more than double* the unmanured plot, the yield on which is still 17 bushels per acre.

On this soil, by good tillage alone, 17 bushels of wheat are annually grown. The object is to get a heavier crop. It was supposed that "as the crops on a field diminish or increase in exact proportion to the diminution or increase of the mineral substances conveyed to it in manure," superphosphate of lime, potash, soda, lime, magnesia, sulphuric acid, chlorine, and soluble silica, or the *ashes* of the wheat plant, would increase the crop; *but they did not*. Liebig's patent wheat manure was also tried in vain. But ammonia, in whatever form used, increased the crop. Six pounds of ammonia gave an extra bushel of wheat. But this extra increase only contains nitrogen equal to one pound of ammonia, and it is supposed that the remaining five pounds are evaporated through the plant, and that this loss of ammonia is necessary to the growth of the plant, or, at all events, there are at present no other known means of enabling the farmer to *increase* his wheat crop over 17 bushels per acre.

Liebig denies that any loss of ammonia takes place; but he has no evidence, aside from Mr Lawes' experiments, on which he bases his denial. His argument is this:—If the plot without manure produces 17 bushels of wheat per acre, and one with 102 lbs. of ammonia 34 bushels, and if the increase is due to ammonia, it follows that the 17 bushels grown on the unmanured acre must also have required and removed from the soil 102 lbs. of ammonia. This we must fully admit. But Liebig says: "Such a conclusion it is impossible to support by any fact." This is his whole argument. It is "impossible" that the soil should contain, or that the rain and air should supply, such a quantity of ammonia. A strange argument this, to be made by the very man who taught that if plants were supplied with a sufficient quantity of mineral elements in an available condition, they would obtain all the ammonia they required from the atmosphere; and that, in the language of Prof. Horsford, "the ammonia spread on fields in the ordinary distribution of barn-yard products, is of no moment. The quantity with usual falls of rain *greatly exceeds, in the course of a season, any conceivable supply by human instrumentality*" Now that it suits Liebig's purpose, we are told that it is impossible that the soil, the atmosphere, and the rain combined, could supply 102 lbs. of ammonia—an amount contained in 600 lbs. of Peruvian guano, or in 5 tons of *good*, or 10 tons of poor, barn-yard manure! Furthermore, Liebig, in his *Chemistry in its Application to Agriculture and Physiology*, when speaking of the quantity of ammonia brought to the soil in rain water, says: "If a pound of rain-water contains *only* one quarter of a grain of ammonia, then a field of 26,910 square feet must receive annually upwards of 88 lbs. of ammonia." An English acre contains 43,560 square feet; and according to this estimate, which we are given to understand is a low one, 142 lbs. of ammonia are brought to an English acre of soil by the rain which falls in twelve months. This estimate was made to show that farmers need not be at any pains to provide ammonia for their crops, as the atmosphere would supply a rich abundance—and, indeed, 142 lbs. of ammonia would provide more nitrogen than the grain and straw of the heaviest wheat crop contains! Now, when Mr. Lawes contends that the atmosphere and rain-water cannot supply the wheat plant with sufficient ammonia for a large crop, because *it destroys ammonia during its growth*, Liebig turns round and oracularly declares this destruction "impossible," because "the soil" [of the unmanured wheat plot] "must have contained or received from the air or rain, *in seven years*, 618¾ lbs. of pure ammonia." In other words, it is impossible this destruction should take place, because the soil, the air, and the rain combined, cannot furnish in a year 88½ lbs. of ammonia per acre, while, according to Liebig's own estimate, the rain-water *alone* furnishes 142 lbs. of ammonia. It is difficult to argue with a writer who resorts to such pitiable subterfuges.

We have brought forward what we deem conclusive evidence, that there is a great loss of ammonia in the growth of wheat. Liebig endeavors to set it aside by saying that the ammonia in Mr Lawes' experiments acted beneficially because it rendered the phosphates of the soil soluble. We conceive that we have fully answered this objection. Assuming that the action of ammonia is in rendering the phosphates soluble, Liebig says:

> "If it had accidentally occurred to Mr. Lawes to manure his field with four, five, or six cwt. of ammonia salts, instead of 3½ cwt., and if in those cases the yield was not increased (as we may *with certainty* assume would happen,) then he might with the same justice assert that the loss of ammonia is 6, 8, or 10 lbs. for every bushel of increased yield. * * * It seems never to have occurred to Mr. Lawes to determine the minimum of ammonia which was effective upon his field in producing maximum crops."

We trust Liebig had not Mr. Lawes' papers before him when he penned these sentences, otherwise he is inexcusable. Ammonia has been applied in these experiments in *hundreds of instances*, and in various proportions; and in all cases it has produced, where unaffected by modifying causes, an increase, within certain limits, in proportion to the quantity of ammonia; and in no single instance has an increase of wheat been obtained except by a great destruction of ammonia. Quantities of ammonia, varying from 14 lbs. up to 180 lbs. per acre, have been applied; and even in these extreme cases, the increase of wheat is in proportion to the ammonia supplied in manure: the former produced 21¼ bushels, the latter 50 bushels of dressed wheat, or 55 bushels (of 60 lbs. per bushel) of total grain, per acre. The amount of ammonia applied to this latter plot would be contained in about 815 lbs of commercial sulphate of ammonia. And yet Liebig says we may "*with certainty assume*" that if Mr. Lawes had accidentally manured his field with 4, 5, or 6 cwt. of ammonia salts, he would have obtained no greater increase than from 3½ cwt. Now, as we have shown, he *did* apply—not "accidentally," however—*more* than 4, 5, or 6 cwt., *and obtained a proportional increase.* We may "with certainty assume," therefore, that Liebig has made a great mistake on this point.

The objections which Prof. Liebig has made to Mr. Lawes' experiments, are so utterly without foundation *in fact*, that nothing but his great reputation renders them worthy of notice.

Our remarks are already far too extended, but we have just received the last *Journal of the Royal Agricultural Society of England* (Vol. XVI, Part 1,) in which we find a "Report to the Earl of Leicester, on experiments conducted by Mr. Keary, on the Growth of Wheat, at Holkham Park Farm, Norfolk, by J. B. Lawes," which affords much light on the subject under discussion. It is a report of an experiment in growing wheat four years in succession, by the use of the various organic and inorganic elements of plants, somewhat similar to that on the Rothamstead farm, with this important difference: The soil at Rothamstead is a heavy wheat soil; this in Norfolk is "a light, thin, and rather shallow brown sand loam," which, previous to the introduction of turnipculture by the late Wm. Coke, on this very farm, was considered incapable of growing wheat. A greater contrast than between it and the Rothamstead soil could scarcely be imagined. *And yet the results are the same.*

The same manures were applied to the same acre each year, and the whole of the produce removed. We have not space for the details, but the following are the aggregate results of the four years:

The first acre, on which no manure at all was used, produced in four years, 93½ bushels, or an average of a little over 23¼ bushels per acre each year.

The second acre, dressed each year with 300 lbs. sulphate of potash, 200 lbs. sulphate of soda, 100 lbs. sulphate of magnesia, and 350 lbs. of superphosphate of lime (200 lbs. calcined bone-dust and 150 lbs. sulphuric acid,) produced, in four years, 92 bushels, or an average of 23 bushels per acre each year.

The third acre, dressed each year with 200 lbs. each of sulphate and muriate of ammonia, applied *in the autumn*, produced, in four years, 125½ bushels, or a little over 31¼ bushels per acre each year.

On the fourth acre the same quantity of ammonia applied *as a top dressing in the spring*, gave in four years, 124 bushels, or an average of 31 bushels per acre each year.

On the fifth acre, the same quantity of mineral manures (sulphates of potash, soda, and magnesia, and superphosphate of lime,) as applied on the second acre, and 200 lbs. each of sulphate and muriate of ammonia, produced, in four years, 145 bushels, or an average of 36¼ bushels per acre each year.

The sixth acre, dressed with a ton of rape-cake (2000 lbs.) each year, produced, in four years, 147½ bushels, or an average of 36⅞ bushels per acre each year.

The seventh acre, dressed each year with 14 tons of farm-yard dung, produced, in four years, 135½ bushels, or an average of 33⅞ bushels per acre each year.

Without manure the soil produced 23 bushels of wheat per acre; the addition of mineral manures alone gave no increase; ammonia alone gave an increase of 8 bushels; ammonia and minerals, an increase of 13 bushels. From this it is evident that the amount of minerals annually available in this naturally poor soil, were considerably in excess of the quantity of ammonia annually available from natural sources; in fact, that there were minerals sufficient for 31 bushels, while there was only enough ammonia for 23 bushels. But the quantity of minerals annually rendered available by the disintegration of the soil, &c., although considerably in excess of the *natural* supply of ammonia, was not sufficient for more than an annual crop of wheat of 31 bushels per acre. To obtain more than this, it was necessary to supply, in addition to ammonia, a greater or less quantity of the mineral elements of plants. When these were supplied, the produce rose to 36 bushels.

The fact that, under these circumstances the mineral manures were taken up by the plants, and gave an increased crop, is conclusive evidence that they were in an available condition, and that their failure, when used alone, in these and in the Rothamstead experiments, is attributable to a lack of ammonia in the soil, and not to their being in an unsuitable form or improper proportion. It demonstrates that although a soil abounds in the mineral elements of plants in an available condition, sufficient ammonia or nitrogen can not be obtained from natural sources for a full wheat crop. It is additional proof, if such were needed, that ammonia does not act solely, or in any great degree, by rendering phosphates or other minerals soluble.

The ton of rape-cake was calculated to afford as much ammonia and minerals as were supplied in the artificial minerals and ammonia salts on plot 5. It also contained, in addition, a large amount of carbonaceous matter. It will be seen that the increase of wheat is nearly identical in the two cases, and it follows that the *carbonaceous* matter had no beneficial effect on the wheat crop. This also is a result exactly in accordance with the Rothamstead experiments.

Similar results to the above have also been obtained from experiments made on the farm of the Duke of Bedford, at Woburn, on a soil and subsoil naturally of the poorest possible description.

It will be recollected that Prof Liebig endeavored to set aside the exceedingly important fact that turnips, which contain only a relatively small proportion of phosphoric acid, require in the soil, in an available condition, more of this substance than wheat, the ash of which contains five times as much as that of turnips. We showed that he founded his objections on a *single typographical error*, which he might have discovered on the next page We shall not again allude to the results of Mr. Lawes, experiments on this point; they are so conclusive that he must be blind indeed who cannot see that they explode the idea that we can tell what manure is best adapted to this or that particular crop from an analysis of its ashes. Our object in alluding to the matter, is to mention that, in the last *Journal of the Royal Agricultural Society*, Dr. Augustus Voelcker, Professor of Chemistry in the Royal Agricultural College, Cirencester, England, gives an account of some experimental trials made on the farm connected with the College, to ascertain "the comparative value of different artificial manures for raising a crop of Swedes" or ruta bagas, the results of which also accord with those obtained by Mr. Lawes. We have not room for the details of the experiments, but will quote a few of the remarks of Dr. Voelcker:

"An extended experience has proved, in the most positive manner, the specific action of phosphatic manures, and the decided advantages which result from their application to *root crops.*"

"Numerous comparative field experiments have established the superior value of superphosphate of lime as a manure for *root crops*, and have shown likewise that the greatest fertilizing effect of guano is realized by applying it to a white crop or to grass land."

"Ammonia does not exhibit the same powerful effect on other crops which it does on the cereals."

"Ammonia does not benefit root crops in an equal degree as white crops; whereas, phosphatic manures exercise a specific action on roots, which causes them to swell, and thus to increase the crop."

"Phosphoric acid, applied in a form in which it can be readily assimilated by the growing plant, *more than any other fertilizing constituent* benefits root crops."

"On the whole, we may learn from these experiments, that the value of different artificial manures for a crop of Swedes, and no doubt also for other root crops, principally depends on the amount of phosphoric acid contained in them in a form in which it can be readily assimilated by the plants."

The experience of practical farmers also agrees with these experiments, in according to available phosphoric acid a high value as a special manure for turnips. One manufacturer alone sold, in Great Britain, last year, 14,000 tons of superphosphate of lime, to be used as a manure for—what? For wheat, which contains so much phosphoric acid? No; but for turnips, which contain so little.

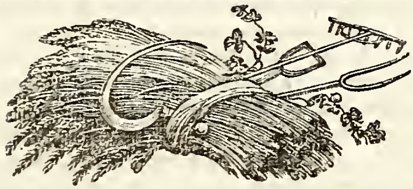
To conclude, these results point to no "revolution" in agriculture; they simply throw light on the *rationale* of systems of rotation and general farm management, already adopted by practical agriculturists. They say "underdrain your land, so that the rain water, as it filters through the soil to the drains, may leave its ammonia for the use of plants. Grow more clover, peas, beans, tares, lupines, turnips, and other plants, which will retain all the ammonia brought to them in rain and dews, or obtained from the atmosphere, the soil or manure. In feeding cattle, use that food which, other things being equal, contains most nitrogen, for the excrements will be correspondingly rich in ammonia. In short, in everything you do, let it be your aim to conserve as much ammonia on the farm as possible. In this you cannot go wrong, for there is no means of getting ammonia in any considerable quantity but what at the same time affords more of the mineral elements of plants, in proportion to the wants of wheat, and probably of Indian corn, barley, oats, and other high priced cereals, than it does of ammonia. To illustrate: good Peruvian guano is the most ammoniacal manure in the market; and yet it contains generally as much phosphoric acid as it does of ammonia; while, according to Mr. Lawes' experiments, a bushel of wheat removes from the soil five times as much ammonia as it does of phosphoric acid. In nearly all substances used as manure, the proportion of mineral elements relatively to the wants of the wheat plant is greatly in excess of the ammonia which they contain.

We cannot impoverish the soil of minerals, therefore, by growing large crops by the aid of such manures as are now in the market, if the straw and home sources of manure are properly husbanded.

But, the reader will ask, If we obtain large crops of wheat, corn, &c., by accumulating ammonia in the soil by the growth of turnips, peas, clover, &c.,

shall we not in this case impoverish the soil of minerals? Yes, it is possible to impoverish the soil in this way, but as turnips require for their growth more phosphoric acid than wheat and beans, and clover more potash, the soil will refuse to grow these crops from lack of minerals much sooner than wheat. As long as we can grow good crops of turnips, peas, beans, and clover, we may be sure there are sufficient minerals in the soil for the largest wheat crop.

Were the "mineral theory" correct, man would possess the power of utterly *exhausting* the soil; but according to the views we have set forth, this power has been wisely withheld from him. Impoverish it he can and does, but to exhaust it by any natural and economic means is beyond his power.




# THE SOUTHERN PLANTER.

RICHMOND, APRIL, 1856.




## THE OHIO FARMING AND STOCK BREEDING COMPANY.

It strikes us that one of the most promising enterprizes we have heard of for some time is the one which is described under the above heading in a late number of the Ohio Farmer.

It seems that a company of farmers, with, we presume, ample means, and of considerable experience, have formed a partnership for ten years, renewable at the end of that time, for carrying on farming and stock breeding. The stock is made up of shares of $1,000, and the company will commence operations with $20,000, cash paid in. They have purchased some 8,000 acres of land in Butler county, Iowa, near a railroad now in process of construction. They will immediately commence building and cropping, and in about a year will send out 50 or 60 brood mares, well selected and stinted to some of the best and most fashionable horses in Ohio. A like number of shorthorns—cows and heifers—will be sent out at the same time. Then the superintendent, Dr. Sprague, at present corresponding secretary of the Ohio State Board of Agriculture, will take charge of the farm. He—

"Will open a set of books, prepared with a view to keeping a systematic account of operations on the farm; charging the farm with moneys invested in the land, in improvements, breeding stock, implements, labor, and all other investments and expenditures; giving credit for all produce sold or consumed, pasturage, moneys obtained from sale of stock, and (at the expiration of ten years, this being the lifetime of the partnership, but which may be renewed at pleasure,) the worth of the land upon closing up the affairs of the company. An account will also be opened with each breeding animal when purchased, charging for investment and keeping from year to year, giving credit for produce sold or retained for breeding from time to time. No horse stock will be sold, until some fifty young horses have attained sufficient age for service. These will, for six months or more previous to marketing, be thoroughly trained by a good horseman, gaited and matched, and a guarantee for temper and speed furnished, when sold. A like number, or more, will thus be turned off each twelve months, together with a drove of fatted bullocks."

In addition to the superintendant, who is also secretary, the company have a president and treasurer.

We do not recommend any such plan as the best for conducting farming operations for any length of timo, or with a view to profit to be derived thereby. There is too much of the socialistic principle for that; too much of the phalanx order. But we call attention to it as being a plan, if properly carried out, admirably adapted to bringing wild lands into a productive condition in the shortest time, and promising a speculation by subduing rather than by tilling them.

We know of several companies owning large bodies of land in western Virginia, who are expecting to realize their profit on the advanced value of the *unimproved* lands. But it must be very evident that if in addition to the purchase money of the fee simple, an outlay was made for clearing these lands at once, building on them, cropping and stocking them, and thereby rendering them attractive to emigration, that a much higher profit would be realized, and in a much less time. It is probable that most of the individuals owning these lands, have no more money to spare in their improvement, and that many of them are capitalists rather than practical farmers, and ignorant therefore of the means to be employed in reclaiming the territory. If which be the faet, they might increase their capital stock, even at low rates to incomers, in view of the speedy returns of the investment.

The organization of such an enterprise it is not our business to discuss, certainly not here. It is merely our duty to suggest a plan which *must* pay those who will carry it out, and which will advance the settlement of our wild lands by at least a quarter of a century.

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The Index for volume 15, Southern Planter, is now ready for delivery. Subscribers who wish them can have them sent, on application at this Office, in person or by letter.

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## EXTRACT OF A LETTER FROM A SUBSCRIBER.

(*Published by request.*)

"Your article upon "Overseers" treats of a very important subject. One point I hope you will not overlook in your continuation of the article—*the education of overseers.* Not teaching them "the languages," or even "the sciences," but removing from their minds the prejudices against the improvements in agriculture. I know of no bett way of doing this, than by supplying them wi well conducted agricultural journals; and by wa of setting an example to my brother farmers hereby order a copy of the "Planter" to be se to ——— my overseer, and request you charge me with the subscription. If our farme generally would do this, it would be no very hea tax upon them, while it would so increase yo subscription list as to enable you to enlarge t size and extend the usefulness of the "Planter."

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## A FAMILY GROUP IN THE VALLEY ( VIRGINIA.

If we do not in the following pleasing sketch our friend J., recognise the individuals of the pi ture, we at least recognize the class as peculiar a portion of Virginia in which we have—though a different locality—spent some of the happiest well as most instructive days of our lives.

In our cattle forays into the great Valley, v learned to appreciate and admire a people so diff ent from our cis-montane fellow-citizens, that th can hardly be known, and certainly not appreciate except in their own homes. Simple in tastes a unpretending in manners; reserved but warm hea ed; prudent but not cunning; cautious but not d signing; frugal in expenditure and wary in ent prise; manifesting most usually more of public spi than of private generosity; giving freely to t stranger of what they have, and making him *j* rather than *hear* that he is welcome—this admirat population rose in our estimation and swelled our heart at each successive visit we paid the and we deeply regret that distance and differe pursuits will deprive us of future opportunities increasing our knowledge of them.

Not to speak of the living, among whom think we can remember some few friends, we m say in gratitude to the late excellent Major Rob Grattan, of the county of Rockingham, that it w he who first introduced us to the Valley, and ill trated in his own person the virtues we revere his countrymen.

Near Brownsburg, Rockbridge, Va.
February 20th, '56.

Mr. Editor:—I have just read Mr Gilme communications in the Planter with pleasure, a I hope not without profit. I agree with him saying that the Planter should be in the hands every farmer in Virginia, and that through th instrumentality, they could make it a source much valuable information.

It is said that as a man rises in social importan his dinner hour advances. Some men of humb origin and great luck have eaten their way fro plebeian twelve, all down the hours of the afternoo and ended a glorious career by solemnly dini with royalty at eight o'clock. Splendid rewa this for the labors of a lifetime!

The papers tell us, that the Queen of Engla dines at eight o'clock, P. M.; the higher nobility seven; the ordinary country gentlemen at six; t professional people and richer classes of merchar at four or five; the shopkeeper at two or thre rks at one; and working men at twelve. It is of latter class, the bone and sinew of our happy d, that I will say something.

recently spent a night with a very worthy man old friend; and it is of him and his family I i write, as I consider them patterns for the icultnral community. I have known this fam- nearly forty years, and the picture is as near rect as I can draw it.

The custom of this family has been, early to bed early to rise, and as a consequence, they have ome healthy, wealthy and wise, (as to general d management.) There are a half a score of dren, nine out of ten are married and well led. The boys, (as the old gentleman calls m,) all men of fine common sense, strict integ- , and great moral worth. Generally members he church.

This fall, the heads of this family, if spared may ebrate the fiftieth anniversary of their marriage. Thirty-seven years ago, I was first introduced to m, and from that time to this, have spent many hts in their hospitable mansion. It was common hose days for almost every good farm to have a illery. There was one here, but the discrim- ting eye of the good father could not ask aven's blessing upon it, and it was abandoned g before the Temperance Reformation com- nced.

The custom of the father of this family was to up the household every morning the year nd between the hours of four and five. In the ter season, you might see the lanterns moving ut in different directions, to the stables, the l, the smith-shop, &c. At a quarter to six, the n sounds, and the family all come together for ily prayers, none are permitted to absent them- es, if in good health; a chapter is now read the Bible, a hymn sung, and a devout prayer red to the Father of all our mercies, for his ction and guidance in the duties and labors he day, with thanksgiving for mercies and efits received. Breakfast is now announced. e family surround the bountifully supplied table; l's blessing asked upon the provision of his nty. Soon the laborers hie away to the fields, or work-shops. The father, the sons and servants, go out to the different labors of the farm. All are engaged till half past eleven or a quarter to lve, when the horn again sounds for dinner. y the time the teams are properly cared for, and laborers' ablutions performed, dinner is on table, say quarter to half past twelve. In the vest months, when the days are long and the k hard, an hour or two is spent in rest. About down the laborers quit work; an early supper aten. The family again called together for ning devotion, before the children yet get sleepy, r which the family generally retire to rest, ly later than nine P. M.

The father of this family has taught his sons and ghters to wait upon themselves, and never call rvant to do what they can do equally well them- es. They are models of industry, economy, thrift. They are public spirited, charitable social; all owning servants, but not ashamed abor with their own hands. Their general th is good, and I do not know that there has a death in this family, children or grand chil- , for near fifty years. Surely God has watched r them, and kept them; has smiled on them approved their walk.

he manners of the good old pair are primitive, r mode of living plain, but abundant and sub- tial. Their hospitality proverbial.

25th.—I again resume my pen, to speak of my friend as a farmer. When he commenced business his means were limited, but from close application, good economy, and strict integrity, he has become possessed of a good estate, and might now retire and live on the interest of his money; but he is still an active man, superintending his farm and work-shops, being by nature a mechanic. His horses are always in fine condition, as is his stock of every grade.

His farming utensils are of the best kind, and always in good order, his lands are well tilled, and in proper season; and as a consequence he rarely ever fails having good crops. His fields are well grassed, and his hay crops abundant and of fine quality. The products of the farm are wheat, corn, oats, grass, cattle, horses, pork, butter and other minor matters. Having always something on hand that would command a fair price, and as every thing he offers for sale is in good condition, he rarely fails in getting remunerating prices. Everything passes under his personal supervision, and as his wish and prayer is to do what is right, he rarely does wrong; and I am satisfied never does so intentionally.

As before remarked, his family are all married and settled, but the youngest. As they paired off, each one received some substantial aid, and all are comfortably settled. If not wealthy, they are well to do, and perfectly independent; owing no man anything, but what can be paid when called for.

This good old father informed me some years since, that his intention was, as near as he could, to divide his estate equally among his children.

Yours, &c.,

J.

## MESSRS. LAWES AND GILBERT vs. LIEBIG.

The article in this number on the controversy between these distinguished experimenters will well repay the cost of perusal. It gives the substance of the whole controversy, and some of the most important and practical results of Messrs. Lawes' and Gilberts' experiments.

We are indebted for it to Joseph Harris of the Genesee Farmer, an agricultural chemist, whom we esteem and confide in as a candid, reliable and scientific man.

## RARE FLOWER SEEDS.

We have recently received from Mr. James Vick, of Rochester, N. Y., proprietor and co-editor of the Genessee Farmer, a collection—*not* for distribution—of rare and beautiful specimens of flower seeds. They are a portion of what he has just imported from France, and will be found, we think, of very superior quality.

## EXPLANATION TO SUBSCRIBERS.

Several of our friends are surprised, and some indignant, that their accounts are sent to them, when they have paid our agents.

The reason we send the accounts is, that the agents have failed to make returns, and cannot now be got to do so, though written to repeatedly and urged to settle. We therefore are ignorant who have paid and who have not.

Just now we are in a general muss with our subscribers in the Northern Neck, many of whom have paid our agent there, who has never paid us one cent.

We except all *amateur* agents, if we may so call our personal friends, who have kindly consented to act gratuitously for us. They have all, so far as we recollect, remitted punctually, and we are the more indebted to them in that they are acting without any compensation and are taking a good deal of trouble on their hands.

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As we have one or two rather lengthy articles in this number, we shall defer the completion of what we had to say about Overseers until our next.

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BLACKWOOD AND THE REVIEWS.

We have received from the publishers, Messrs. Leonard, Scott & Co., 79 Fulton street, New York —Woodhouse, Richmond—the February number of Blackwood's Edinburg Magazine, containing a variety of articles, which we have not had time as yet to look into.

We have also received the January number of the London Quarterly, containing Table Talk, Reformatory Schools, Reviews of the Life of Fielding, Landscape Gardening, the Zoological Gardens, &c. The Table Talk is a good article, and the Landscape Gardening, and Zoological Gardens, are both very instructive and entertaining.

The Edinburg and Westminster for January have also come to hand. In the former the articles headed respectively, Rural Economy of France and Britain, and the Minister Von Stein, and the Life and Writings of Henri Bayle, will well repay perusal.

In the Westminster we have only been able to read the article on German Wit, which is not particularly witty; but quite interesting, as it gives a sketch of the great Henrich Heine, recently dead, and esteemed, next to Gœthe, the greatest literary writer of Germany.

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RELATIVE PROGRESS OF VEGETABLE FOOD IN THE UNITED STATES, AND THE INCREASE OF ANIMALS.

In two or three articles recently prepared for the Record, we have shown, first, that the increase of the classes engaged in the various branches of the arts and commerce was much more rapid than that of those engaged in agriculture; and second, that the town or civic population, was increasing much more rapidly than that of the country, or rural population. In connection with these facts, we may remark *en passant*, and as intimately connected with them, that the prices of agricultural products have been for several years gradually growing higher, while, on the other hand, the prices of manufactured goods have generally declined. This rotation of prices is perfectly consistent with, and, indeed, is a direct consequence of, the former facts, which we have stated and illustrated in preceding articles.

We shall now proceed to inquire whether vegetable food, which is the basis of all animal life, has or has not increased in the United States in proportion to the increase of population. If it has, we, at least, whatever may be the case with others, have not lost ground in relation to the due support of animal life. If it has not, then all the boasts we so frequently see in the newspapers, about an unlimited power to supply Europe with food, is a mistake and a delusion. While we are obliged to use the returns of the census of 1850 as a basis; we are well aware that the crop of 1849, on which it was based, was comparatively a bad one, and the present crop (55) is a vastly better one. Nevertheless, it is probably true that the crops of 1854 and 1855, taken together, would not make more than an average production. Comparing, then, the crops returned in the two censuses of 1840 and 1850, and the increase with the increase of population, we shall get a very near approximation to the relative growth of food and population in the United States. In doing this, it is not necessary to give the smaller crops in detail, but only the large crops, which support men and animals, and with them the number of men, and the number of animals which are used as food. The latter is not essential, for vegetable food of some kind is the basis of all animal life, and therefore to determine the crops is to determine all. But the number of animals used for food will illustrate the conclusions, and therefore we give it.

In the table below, the first column gives the number for 1840; the second for 1850; the third the ratio of increase; and the fourth the variation from what *ought to have existed* in 1850, in order to be equal to the ratio of increased population:

| | 1840. | 1850. | Ratio per ct. | Variation. |
|---|---|---|---|---|
| Population, | 17,069,453 | 23,191,876 | 36 | 15,000,000 |
| Bushels of-- | | | | |
| Wheat, | 84,823,272 | 100,485,944 | 20 | 76,000,000 |
| Corn, | 377,831,875 | 592,071,104 | 57 | 76,000,000 |
| Rye, | 18,645,567 | 14,188,813 | — | 11,000,000 |
| Oats, | 123,071,341 | 146,584,179 | 20 | 20,600,000 |
| Hay, | 10,248,108 | 13,838,642 | 36 | — |
| Cattle, | 14,971,586 | 18,378,907 | 24 | 1,800,000 |
| Sheep, | 19.311,374 | 21,723,220 | 13 | 4,500,000 |
| Swine, | 26,301,293 | 30,254,213 | 15 | 4,600,000 |

Here it will be seen that there is a deficien-y in everything, except corn; that is, there is ss than there should have been in order to ake the amount correspond with the increase f population.

In regard to corn, at least 15,000,000 of ushels of the increased product is used in hiskey, which enters not at all into food. educting this, we have the following results:

| DEFICIENCY. | |
|---|---|
| Wheat, | 15,000,000 bushels. |
| Rye, | 11,000,000 " |
| Oats, | 20,000,000 " |
| Total, | 46,000,000 " |
| Increase of corn, | 61,000,000 " |
| Apparent gain, | 15,000,000 " |

But it must be observed that wheat is al-ost exclusively used among the white in-abitants for bread; and that of corn we are ow exporting (which we formerly did not) an mount equal to the apparent gain. On the hole, it is apparent that the increase of veg-table food, in the United States, has rather llen behind than kept up with the progress of opulation. It is also apparent that, in future, he great staple in breadstuffs for us, and for he world, is the maize, or Indian corn. This the only crop, even in our fertile country, hich keeps up and goes beyond the increase f population. It may be well to look for a oment at the increase of this crop. We have he following data for a calculation, viz:

| | |
|---|---|
| orn crop of 1840, | 377,531,875 bushels. |
| " " 1850, | 592,071,104 " |
| Annual increase, 6 per cent. | |
| rop of 1855 calculated on this basis, | 800,000,000 " |
| robable crop of 1856, | 1,000,000,000 " |

This increase, however, will not take place nless we find a foreign market, which we shall robably do. On this head we intend here-fter to give the data for supposing that the apid increase of the corn crop will continue.

One of the most remarkable facts in relation the diminution of the agricultural produc-on, is that of the diminished relative increase f animals.

Take the following proportions:

| | |
|---|---|
| crease of population, | 36 per cent. |
| Do horses, | 14 do |
| Do cattle, | 23 do |
| Do sheep, | 13 do |
| Do swine, | 15 do |

These are very instructive facts. They ach very distinctly some of the principles hich have been silently at work to raise the ices of wheat, of beef, and pork; nor do we e from this state of things any remedy but e increased application of labor to agricul-re, and, as there is no power to enforce this it the presence of a real scarcity, so we can e no permanent diminution of prices; nor indeed a probable cessation of the rise, till high prices react in producing a renewed at-tention to agricultural employments.

There is another question connected with the production and consumption of vegetable food, of great interest and importance. Other parts of the world are even less fortunate than ourselves. The result is that there is a pressure upon this country to supply the wants of Europe. The export of breadstuffs at this time, is beyond anything this country has ever known. With high prices and a good harvest, this demand will be supplied for a time; but, as the facts above stated prove that our surplus, especially of wheat cannot be very large, it follows that this de-mand, if continued, will so far exhaust the country as to make prices still higher, and, in fact, almost exhaust the home supply of wheat flour. If this be repeated from year to year, where will it end? Can we increase the supply of wheat so as to meet a perpetual Eu-ropean demand for grain? or, must the people of Europe come here in still greater numbers? or, finally, as we just remarked, is not Indian corn the last resource and hope of nations?

Our opinion on this subject is fixed; that, as corn is the great staple of our country—is easily raised, and may be indefinitely extend-ed, that this crop will go on increasing, at a very rapid rate, and it will be exported to Europe in immense quantities. In looking to the increase of vegetable food in the United States, we think it evident that the produc-tions which are likely to increase most rapidly are those of corn, potatoes, sugar cane, and grapes. If we are right in this supposition, the United States have yet before them a field of vast enterprise and profit in agriculture.

Since the introduction of Texas, the land suitable for the cultivation of the cane has been greatly increased. We suppose there can be no doubt of the capacity of Louisiana and Tex-as to raise a million of hogsheads of sugar, without any great effort. This is equal to a thousand millions of pounds—quite a large item in the general provision of food.

The vine is a recent and much smaller ad-dition to our agricultural list. But large parts of the United States, and especially the valleys of the Ohio and the Missouri, are ad-mirably adapted to the cultivation of the vine. The time is not distant when millions of gal-lons of wine will be made on the Ohio.

The potato is a native of America, but has been much less attended to in the United States than it ought to be. At 100 bushels per acre, which with suitable soil and culture is a small crop, it is one of the most profitable raised.

We conclude, therefore, that while it is an entire mistake to suppose that the United States can supply the world with wheat, when the world has driven its agricultural laborers into the hot beds of cities; yet, the United States has a staple grain in Indian corn, which can supply the world, and there are new crops with which America can enrich itself.—*Railroad Record.*

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*Communications to the Virginia State Agricultural Society.*

## ESSAY ON BLUE CLAY.

By Robert Harrison, M.D., of Prince George.

[*A Premium of Ten Dollars.*]

I design in this communication to present to the consideration of the State Agricultural Society of Virginia, my experience in the use of blue clay and the effects resulting from its use.

My farm is located in the county of Prince George, three miles south of James River; the land is generally light, with a clay subsoil, but portions of it have no clay substratum. On portions of this farm marl is found varying in strength from 25 to 75 per cent. All the arable land has been marled in the proportion of 300, or more, bushels to the acre. And the most of this marling was executed at least fifteen years ago.

This marl is about six feet thick, mostly dry, of a buff color, containing clam shells, oyster and other shells, some perfect, others decomposed partially; next to this marl is found a blue marl, inferior in quality, of a blue color, abounding in sand. This marl contains very large bone, some of the vertebral bones measuring eight or ten inches in diameter. This blue marl is about four feet thick. Immediately subjacent is found this blue clay, of unascertained depth, but which has been excavated to the depth of twelve or fourteen feet. This clay in physical appearance presents a homogeneous mass, but by careful examination it is found to contain innumerable shining particles. This clay is blue in its appearance, feels and cuts like soap, tenacious but somewhat friable. By atmospheric exposure either at the pit or after having been applied to land it soon breaks up into small masses sufficiently fine to be spread with a spade or hoe, or even to be scattered with the hand, as I have sometimes used it as a top dressing to clover. Rain and freezing also sufficiently disintegrates it for agricultural purposes. I consider it one of our best fertilizers, not inferior to lime or marl, abounding in carbonate of lime. Its use was commenced by me more than twelve years ago. It was analyzed by Professor Hare, of the University of Pennsylvania, but I have misplaced the report. He was of opinion that it possessed no fertilizing property whatever. Professor Rogers, of the University of Virginia, also subjected it to analysis—"Composed, (he says) almost entirely of a silicious clay, having a few shining particles of mica.

Silica, } almost entirely.
Alumina, }
Oxide of Iron, about 7 per cent.
Carbonate of Lime, a trace.
Sulphuret of Lime, a trace.
Carbonaceous Matter, a trace.

It abounds in Alumina, Bisulphuret of Iron, Sulphuret of Lime, Acid, Ammonia, and some other ingredients according to another analysis, but many grains of allowance should be made for the present infancy of agricultural chemistry.

The first experiment I made with this clay was upon a remarkably light piece of land that I was endeavoring to improve by the application of our common red clay; at the same time I hauled out about twenty bushels of this earth. It was here spread, sown in oats and clover seed; the clover vegetated upon all, but died out during the summer upon the land upon which the red clay had been applied, but continued to grow finely and luxuriantly where the blue clay had been applied; and during this year some of the stalks of clover grew to be knee high, and was the best on the farm. After this, I have continued to use it from year to year, until I have nearly applied it to every part of the farm, and some portions twice, with very satisfactory results. Upon some portions of the light land I have known the blades of corn to turn yellow, but whether it was owing to a superabundant application of this earth or to other causes, I have not yet satisfied myself, but uniformly it makes the land produce more corn and the blades are of a deeper green. On wheat, the increased product, particularly on my light fields, has been very apparent, both in the growth of the straw and the number of bushels. This earth is particularly adapted to the growth of peas. I think I may safely say the growth of the vines have been nearly doubled since the commencement of its use. Now all my corn land is sowed down in peas, unless I am deficient in seed. This gives me an additional product of wheat, that I estimate at four to five bushels to the acre. This mode of getting a green fallow with peas I consider to be the more economical with me, and I get a more luxuriant growth. I avoid the trouble and expense of fallowing land exclusively for peas, and the trouble of getting in the peas is much less with the corn, for it is not necessary to give any additional ploughing, and I am not yet satisfied that the pea crop produces any detriment to the corn crop. But I have now an experiment in progress to ascertain the fact.

I have taken some pains to sow my land in eastern shore bean, and here again the value of this manure is very apparent, the beneficial effects being equal, if not greater, than when applied to peas; but this latter plant belongs to the pea tribe.

My usual mode of using it is by applying about a hundred and fifty bushels to the acre.

But this year I applied about two hundred bushels more to land that had had an application of an hundred and fifty bushels of this earth. My corn is decidedly better than it ever was on this field before, and the peas as luxuriant as if they had been heavily manured; but where this earth was applied this year the peas were much better than the peas on the land which had had an application of this earth three years ago.

It is true, for several years I have been remarling my lands, also with marked benefit; but it is only with the marl I remove to get access to the blue clay, as I consider I get more benefit from the latter than the former. This opinion is not peculiar to myself. Dr. A. Bryant, a farmer of Prince George, informs me that he has discovered greater benefit from the use of his marl than is manifested by that of his neighbors, and he attributes the superior benefit to the fact that he is in the habit of mixing about four feet of this clay, which he finds at the bottom of his marl pits, with his marl. So far as my experience goes, I have never used this blue clay to lands that had not been marled or limed. I carried some a distance of four miles, and applied it to land that had been limed—a close, stiff, tenacious soil; and applied it to clover with marked benefit.

This earth acts promptly. On one occasion, the clouds indicated rain; I ordered a boy to haul several loads and scatter it on clover, and in a very few days the benefit from its use was very apparent in the increased vigor and greenness of the clover. This earth is soluble in water. Soon after a rain, if one rides or walks in a field on which this earth has been spread, a strong sulphureous odour is manifest and rather unpleasant; the same may be discovered at the pits. This is much more evident after a rain than at any other time.

Again, another fact connected with the solvent powers of rain is, that vegetation is considerably increased in the direction of the descent of water where this earth has been applied on the sides of hills.

It is beneficial to lands that have not been limed or marled, to our knowledge.

Mr. W. Gee, of Prince George, who lives twenty miles south of James River, has used this earth, and also what is called olive earth, with decided improvement upon lands that had had no lime or marl; but this land may be naturally calcareous. This blue clay is found at the bottom of his marl pits; he applies about three hundred bushels to the acre. A portion of his land was remarkably poor and light; he observed it has been in succession of crops under the regular rotation, for a great number of years, and was unproductive, producing only about one and a half bushels of corn to the acre. After the application of this earth, without any additional manure, the same land produced about four barrels; wheat and clover also grew successfully.

Another fact connected with this earth is of a very important character. The sheep sorrel, a plant common with us and remarkable for the acidity of its leaves, generally disappears after land has been marled or limed; but it reappears after the use of this blue clay and grows more abundantly and luxuriantly, and this is the most serious objection to the use of this clay. Now this fact presents a stubborn reality against some of the fashionable theories of the day. Hen peas are increased in quantity and are more productive; the eastern shore bean becomes more abundant, and the clover increased in growth and improved in color; corn and wheat increased by the application of an earth that causes the sheep sorrel to reappear on land from which it had disappeared by the use of marl and lime. From this and other considerations, I should infer that acidity is not opposed to fertility.

This earth also possesses the power of counteracting the injurious consequences resulting from an over application of the carbonate of lime, or what is popularly called marl-burnt land. The bisulphuret of iron being placed in justaposition with carbonate of lime, chemical affinities may produce new combinations. Sulphuret of lime may result, and productiveness the ultimate consequence, or the caustic properties of the lime may be neutralized. On my farm an example may be seen of a piece of land in which all vegetation was destroyed, mould, &c., gone, and the land presented the appearance of worthless sand, which has been restored to comparative productiveness by no other manure than this blue clay. This clay is usually hauled upon the land after it is broken up, suffered to remain until it breaks up into flakes or becomes somewhat pulverized, when it is scattered. Here we occasionally find round balls about the size of large marbles, presenting a dirty appearance on the exterior, but internally these balls are crystaline. To what principle, to which ingredient in its constitution are we indebted for its fertilizing property? Is it because its metallic oxide forms a base with which humic acid unites, and this combination is subsequently easily dissolved by rain water, and is thus assimilated by the growing crops—or may not this oxide form other combinations with lime or other inorganic substances—or may it not more properly be a positive manure, independent of chemical affinities or atmospheric combinations?

We are thrown upon the ocean of conjecture; theory may be piled upon theory, and one hypothesis upon another without affording satisfaction to the man of science, or without materially benefitting the agriculturist.

Professors Hare and Rogers inform us that alumina abounds in this earth. Who knows the effects of whale oil, fish oil, &c., uniting with this earth? It is impervious to water in its present condition in the pits. It may in this form retain other organic animal matter. But it is not my object to discuss a theory or advocate a system, but to invite the attention of farmers to the use of this invaluable fertilizer.

The effects of this earth on the appearance of my land, on my growing crops, upon peas, vegetation, clover and eastern shore bean are positive realities, and I shall continue to use this earth so long as beneficial results follow its use.

Blue clay is considered by some to be a peculiar deposit, but we consider its fertilizing property dedends in a great degree upon the animal matter formerly existing in the superincumbent marl, united with aluminous and ferruginous earth; for we have never heard of its existence with us, without being accompanied with marl, or unmistakable evidence that marl pre-existed. Does this not go to render it highly probable that they are intimately connected, and its efficiency dependent in a great degree upon the animal matter, previously existing in the marl above; also, from the decay of large whales, the bones of some now remaining, and yet found in removing the marl. This clay consists of many of the ingredients of guano, phosphoric acid, soda, potash, ammonia, and sulphuric acid.

Now phosphorus, sulphur, potash, and soda are found to exist in the ashes of plants.

In this earth are many of the essential ingredients of vegetable organizations; ready when dissolved to be absorbed, and assimilated by the growing crop, after its application to the soil.

In Vol. XIII. No. 4 of the Southern Planter, page 165, in an analysis of a fine blue clay, from Marlbourne farm, which consists of carbonate of lime, sulphate of lime, bisulphuret of iron, potash, soda, phosphoric acid, alumina, an oxide of iron, organic matter and water, silica, ammonia from the organic matter. In appearance and physical properties, Professor Gilham says: "This clay is like the blue clay mentioned in my essay, and I have but little doubt it is equally fertilizing." Agricultural chemistry has made rapid improvements, and yet the science may be said to be in its infancy. The agricultural community are under many obligations to Professor Gilham, for his valuable contributions to agricultural chemistry.

If the present surface of this earth was formerly the bottom of the antedeluvian ocean, which seems to be the fact from the discovery of marine shells on the Pyrennean mountains, 10,000 feet above the level of the sea, and other evidences of a deluge; and the fact also established, from the discovery of the rhinoceros, an animal of the equatorial regions, and also the mammoth, in a frozen condition in Siberia and the arctic regions, this whole country must have been submerged by sea water, abounding in muriate of soda; and Sir Humphrey Davy informs us that muriatic acid, acting on animal or vegetable fibrine, albumen or caseine, changes it to a purple color. Therefore we conclude, this blue clay owes its color to the action of sea water on these organic constituents of animal matter. So the color itself would go to prove the probable presence of either animal or vegetable matter, neither does its chemical analysis conflict in the least with this supposition, but rather goes to establish the probability, that animal or vegetable matter, or both, in a decayed condition, exists in combination with aluminous and ferruginous earth.

Red clay is immediately in contact laterally with this blue clay, and the line of division is of an intermediate color.

From the application of this earth to our soil peas are increased in quantity, and are more productive; clover is increased in growth and improved in color; corn, wheat and vegetation improved by the application of an earth, that causes the sheep sorrel to reappear on land from which it had disappeared by the use of lime or marl. From this fact and other considerations I should conclude that acidity is not opposed to fertility or increased productiveness. Now I do not think that sorrel seeds are carried in this earth, nor believe in spontaneous generations; but the lime having destroyed or neutralized the acid, necessary for the growth of sorrel, this blue clay restores it, or liberates it either directly or by combination, and the sorrel having the elements necessary for its growth restored, grows more luxuriantly after this earth than it did previous to liming or marling.

I suppose the seeds of the sorrel had remained in the earth for years, and it only required the necessary material for its growth and development.

Now if the disappearance of sorrel is an evidence of the correction of the acidity of the soil, and the existence of a certain degree of alkalinity, then the reappearance of the sorrel is the evidence of the restoration of the acidity, and increased productiveness is the consequence, going to prove that acidity in a soil is not the cause of its poverty.

It is the generally received opinion in our vicinity, that our lands that have had an application of marl or lime, in sufficient quantity, are not troubled with sheep sorrel after these alkaline earths are fully incorporated with the soil. There are some exceptions to this rule, but what are the modifying circumstances we are unable satisfactorily to explain.

The sorrel (*Rumex acetasella*) is remarkable for the agreeable acidity of its leaves, which is chiefly dependent on the presence of the binoxolate of potash. Oxalic acid is formed in both the animal and vegetable kingdoms. It is found as an oxalate of ammonia in guano, which accounts why sorrel so frequently follows its use.

Many other plants besides the sorrel produce it, such as rhubarb, valerian and lichen. It is also produced from a diseased condition of the kidneys of animals.

Now the sorrel does not grow on all soils, but with us it generally grows on light and sandy soils, sometimes in isolated patches, again more generally distributed over a field. Now, this oxalic acid, which predominates in the sorrel, it is fair to conclude, must exist in certain localities favorable for its formation, and wherever it does exist we have a soil favorable for the growth of sorrel. But oxalic acid has a very strong chemical affinity for lime, so strong that it will unite with the lime that is presented to it, in combination with sulphuric acid or gypsum. Therefore whenever land is limed or marled, in which oxalic acid exists, an insoluble oxalate of lime is formed, and the necessary ingredient for the growth of sorrel is neutralized by the lime, and consequently the sorrel ceases to grow. This appears to our mind, a sufficient reason to account scientifically and satisfactorily for the disappearance of sorrel after liming or marling. Certain plants require particular ingredients for their growth. It is an acknowledged fact, that marine plants will not grow without the presence of muriate of soda. Why will the sorrel again grow after the application of blue clay and guano, unless they abound in acids or favor the generation of oxalic acid? It does exist in guano as an oxalate of ammonia. We know, from the constituof oxalic acid, that vegetable decay and at- pheric air, would furnish carbonaceous matter oxygen favorable for the development of ox- acid. Thus we have attempted to account he disappearance of sorrel by the union which s place with lime by one of its ingredients, ning an insoluble oxalate of lime. In confir- ion of the great value of blue clay, I send a r directed to me by my friend and countyman a most excellent farmer, Mr. Gee.

hus I think is demonstrated, that this earth, in quantity applied, is equal if not superior to vian guano. Poor land that originally pro- ed 4 bushels per acre, afterwards produced 20; ncrease of 500 per cent. This earth, I con- r very important towards the renovation of n out land, and towards neutralizing the alka- y arising from an excess of marl or lime.

ROBERT HARRISON.

ince George, Va.

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SANTA ROSA, Prince George County, Va.
October 15th, 1855.

DR. ROBERT HARRISON.

*ear Sir*:—In compliance with your request, I send a statement of my experiments made with blue clay, ubstance we find beneath our marl beds, &c.

1849 I dug from pits about twenty thousand bushels arl, and in getting out this quantity, I concluded to riment with the two substances usually found above below the beds of marl, called red and blue clay. The er contains no shell, but bears the prints of every kind ly found in the marl bank; the latter contains neither, oes the application of the strongest acids detect in either mallest portion of lime

jacent to my pits, there is a piece of worn out land, ry light soil, and of about eight acres, which had cultivated a great number of years without any im- ement; this I divided into two equal parts; upon the I put three hundred bushels of the red clay per acre, n the other, the same quantity of blue clay; had it d broadcast and ploughed under. In the spring I plan- e whole in corn; it came up well and grew off finely, produced to my astonishment, twenty bushels per each piece producing about the same quantity. This had not produced more than four bushels per acre, in ear, for the last twenty-two years to my knowledge. e fall, I seeded it in wheat, which grew off finely, and a very luxuriant growth until the 14th day of May; at day it was (together with all my crop of wheat,) ely destroyed by a hail storm I had seeded the in clover, and such as escaped being destroyed by ail was of fine growth. After remaining one year in r, it was put in corn again, and produced a crop equal to the first. I then put it in wheat again, which f fine growth, but owing to injury sustained by rust, duced a very indifferent crop. * * * *

Yours, most truly,

WM. GEE.

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*For the Southern Planter.*

## NEGRO CABINS.

DITOR SOUTHERN PLANTER:—I make no apology ffering you a few hints upon the construction management of "Negro Cabins," as the subject important one, and the ideas I offer chiefly ved from a medical friend, in whose sound judg- both you and myself place great confidence. e ends aimed at in building negro cabins ld be: First, the health and comfort of the oc- nts; Secondly, the convenience of nursing, sur- ance, discipline, and the supply of wood and r: and Thirdly, economy of construction.

course, the convenience of locality must be ed of by the builder. I only propose to consider the subject in its economic and healthful aspect, and to this end recommend that negro cabins should be built of plank, have large glass windows and good chimneys; should be elevated at least two feet above ground, and never placed within less than 75 or 100 yards of each other. When inch plank is not worth above $1.25 per hundred feet, I consider the plank house cheaper than either log or masonry. At this price the cost of plank for a house 16 feet square will not exceed $15, for which sum I would not furnish, hew. haul and put up logs to build a house of the same size. The planking is put on up and down, and I use a double course of planking instead of narrow strips; this I find makes a very comfor- table cabin both for summer and winter. If the builder choose to incur a slight additional expense, and should dress the outer course and give it a coat of paint, this, with a projecting eave and some cheap ornamental cornice, makes a very pretty house and obviates the necessity for sticking the negro cabin out of sight of the mansion.

Plank houses are considered by Physicians as more healthy for negroes than log, for the reason that there is constantly accumulating in and about the negroe's house a vast quantity of animal matter in the form of excrements and emanations from the human body, which has fewer places of lodgment and is more easily removed from the plank than the log house. To form an idea of the *strength* of this matter, you have only to call to mind the odour of a sweating negro or the stench which pervades a room in which several of them are sleeping. The Doctors tell us that these smells are clouds of ani- mal matter, absolutely capable of being *weighed* and *seen* as well as *tasted* and *smelt*, and are constantly collecting in the walls and under the floors of negro cabins, and there rot and *stink* as any other putres- cible matter—(you must excuse an unrefined word now and then, for to tell the truth, I can't find a syno- nyme for that word which would at all convey the idea I intend.) This is beyond doubt the fre- quent cause of disease and should be carefully pro- vided against, and hence I recommend the eleva- tion of the floor above the ground, with a view to the frequent cleaning up of this accumulated filth. On my own farm a few years ago, typhoid fever, a disease until then unknown upon it, broke out in an old negro cabin, closely underpinned, and which for many years had been used as a negro house. My family physician advised me to tear away the underpinning and have all the filth cleaned up. In doing so, I found an accumulation of foul matter in layers almost denoting the number of years it had been collecting, which required six loads of a com- mon cart to haul off, and from which came a stench equal to the concentrated essence of all bad smells put together. I would not if I could give you or any other friend of mine an idea of its fœtidness. I tore down the house and found the old logs impreg- nated with foul smells, which continued in them long after they were exposed to winds and rains. The old house was like the "vase in which roses have once been distilled," except that it wasn't ex- actly the "scent of the roses" that hung round it still.

The floors of negro cabins should be of plank rather than dirt, and should be dressed and jointed, but not nailed down, that every plank might be taken up occasionally and cleansed of any filth that may have settled upon them. Lime and other disinfecting agents should be freely used. Negroes should be well supplied with light. They "prefer darkness to light," and unless watched will exclude the light entirely from their houses.

Their houses should be provided with large glass windows, and when a pane is broken they should be made to replace it rather than fill its place with old rags. Light and air are necessary to the proper making of blood; and negro women and children, who spend so much time within doors, should be compelled to enjoy both these elements. They have to be forced to it, for in sleeping a negro will cover his head if his feet freeze, and thus breathe over and over again the same air, charged as it becomes with carbonic acid and exhalations of the body, and deficient perhaps in oxygen, the element so needful in making good arterial blood. It is considered by medical men, I believe, that this bad elaboration of blood develops lurking scrofula and even generates it.

Glass windows enable the negro to do much work "in doors," and are surely more convenient than a lightwood knot in enabling the physician or nurse, in case of sickness, to examine the patient or minister to his wants. I think a doctor has just cause of complaint when forced to burn a negro's eyebrows off with a pine torch before he can get a sight of his tongue at mid-day.

Negro houses should be provided with chimneys that don't smoke. Air-tight stoves are liable to give negroes cold from the extremes of temperature they produce and are objectionable in that they give no light. The Franklin stove is well adapted to negro cabins, and was used by yourself while you lived in Albemarle. Any thing is better than a smoking chimney. On many of our Virginia Farms, I doubt not there is lamp-black enough accumulated in the breathing tubes of the negroes during the night to black the master's boots in the morning.

Cabins should not be placed at a less distance than from 75 to 100 yards from each other, for the reason that it is highly probable that infectious diseases, such as scarlet and typhoid fever, measles, whooping cough, and even small pox may not be communicated at that distance.

Yours truly,

R. W. N. N.

ALBEMARLE, Feb., 1856.

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For the Southern Planter.

## CORN PLANTERS.

MR. EDITOR:—I have tried several kinds of cornplanters. The first was made by Sinclair & Co., Baltimore, which has received the premium at the two last fairs, but which I think is a very indifferent machine in many respects. It is so *top-heavy* that it will take one hand to keep it in proper position, and a more awkward implement I have never seen. After using this one probably in all one day, I laid it aside, and having an opportunity to get *Emery's Planter*, which was highly recommended to me, I purchased it and used it a good deal. The performance of the machine is very good, and I could recommend it, if it were made in a style to suit our latitude; but this is not the case. The gentleman from whom I got it commenced to repair his before getting it to the field.

If some of our Southern Manufacturers would make them in as durable manner as they make other implements for a home market, I do not doubt but what it would be used very extensively, especially by farmers who own large fields, free of stumps and roots.

In haste, yours truly,

RICHARD IREY.

NOTTOWAY, VA., Mar. 14th, 1856.

For the Southern Planter.

## BELLS ON SHEEP.

February 6th, 1856.

*Friend Ruffin*:—In the January number of the Planter I saw an article upon bells "to prevent dogs from killing sheep." When a boy, I passed by Mr. Richard Sampson's farm, of Goochland county, late in the evening, and saw his servants penning his sheep with his cattle. I asked the reason. The boy said it was to protect the sheep from dogs. I remembered it, and have practised it ever since I have owned a sheep, which has been twenty odd years, and have never had a sheep killed or attacked by dogs; whilst my neighbors have sustained great damage, and some have had their entire flock destroyed. I have told my plan and my luck, and strange to tell, I do not know a man who thus pens his sheep; and there is not a man in Albemarle county, who has lost fewer sheep from any and all the evils to which this valuable stock are subject, than I have. Sheep cannot stand dirt, in or out of a pen; my cow pens are frequently moved or well littered, and the sheep always turn out the first thing in the morning, and after a little practice will come to the pens every evening themselves, as if for protection.

Yours respectfully,

G. C. GILMER.

P. S. My sheep boy would not hire for five dollars per year. This winter sheep have suffered much for shelter and for water. To do well, sheep must have water every day.

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For the Southern Planter.

## DITCHING.

February 7th, 1856.

FRIEND RUFFIN:—Yours of the 8th of January was received, and should have been answered, had this been the season for such work. You ask if I have ever tried ditching with the assistance of a horse and coulter. I have for years done much of this work with two horses, a coulter and plough, then scrape out with a cast iron two horse scraper, by which I easily and quickly remove all the dirt from the channel I wish to make, and deposit it in some washed or sunken place, thereby killing two birds with one stone. I can, and have done more work of this kind per day, with one man thus equipped, than could have been done in the old fashioned way of spading and shovelling by fifteen if not twenty as good hands. I do all of my straightening of my creeks, clearing out my mill race, and removing the sand bars, shoals, and obstructions in my creek with my horses and scraper. It is a great labor saving machine. I have never tried it upon the narrow or common ditches of the farm, but will try it as you advise, and inform you of its result and my opinion.

Yours, truly,

G. C. GILMER.

INGLEWOOD, near Cartersbridge
P. O., Albemarle co.

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For the Southern Planter.

## EXPERIMENTS WITH MANURES.

In April 1853, I made a compost of one ton Peruvian Guano, half ton of Plaster, and two tons of leached ashes. I applied this mixture in the hill to corn on about twenty acres of land, ten acres low grounds and ten acres high land (or hills.) This experiment paid a larger profit than any I have ever made on corn. The distance was four feet by two, furrows for planting opened with a two horse plough, the corn dropped, and the compost upon it, and covered with a coulter; on the high land one stalk in the hill, on the low-grounds one and two alternately. The low grounds averaged about twelve barrels, and the high land about six barrels per acre. I think the yield in both cases was doubled by the application.

About the 6th of June, 1853, I applied two tons of Peruvian guano on corn at the rate of 150 pounds per acre, sowed in a narrow string about the corn and covered immediately with a mould-board plough, the dirt thrown to the corn. This application was on low grounds, and increased the yield per acre, I suppose, from two to three barrels.

*Experiments with Guano and Kettlewell's Renovator.*—On a piece of poor low grounds, containing 2200 square yards, I applied between the 5th and 10th of June, 1853, 75 lbs. P. guano, sowed close to the corn and covered immediately with the dirt thrown to the corn; gathered and measured three barrels and three pecks, making about eight barrels per acre. On the same quantity and quality of land, and immediately adjacent, I sowed and covered in the same way one barrel of Kettlewell's Renovator, costing here within a fraction of $4, and gathered and measured two barrels and four bushels of corn. Difference in favor of guano, four bushels and 3 pecks.

4¾ bushels corn at 70 cents $3.32½
75 lbs. Peruvian guano at 2¾ cents 2.06¼

Nett gain $1.26¼ or about $2.75 per acre.

I do not conceive that the Renovator increased the yield at all, and I am led to this conclusion from other experiments I made with it. I sowed seventeen barrels of it on tobacco land in 1853, at the rate of one and a half barrels to the acre, costing per acre here nearly six dollars, and if it benefitted the crop I am entirely ignorant of it. In order to give it a fair trial, I reserved two barrels and applied it in the hill to corn in 1854, according to Mr. Kettlewell's directions, and I could perceive no benefit whatever. Mr. Kettleworth advised its application with Peruvian guano if I had it, and without the guano if I had not. In my experiments I preferred to try it alone, and let it stand or fall upon its own merits.

In 1851 I used about four tons of Peruvian guano on corn land, sowed broad-cast and in the drill from 150 to 200 lbs. per acre; very little benefit was realized from this application, in the increase of grain, except on damp spots, but a decided increase in the quantity of fodder. I also applied two tons Peruvian guano on tobacco land, 300 lbs. to the acre, in 1854, without any decided advantage in the growth of the plant, but I perceive it thickened and ripened faster in the Fall and was ready for the knife earlier than that upon which the application was not made, thus avoiding any risk of frost.

In 1855 I selected damper land (but not subject to inundation) for the application of guano on tobacco, and applied from 300 to 400 lbs per acre in the drill. This experiment succeeded admirably, and, should the tobacco bring a reasonable price, a good per cent will be realized. The same year I measured one acre of poor land, very slightly manured with summer cow pens in 1854, and applied to this piece a compost of 200 lbs. Peruvian guano, 200 lbs. leached ashes, 100 lbs. plaster, and one bushel table salt, costing about $7, sowed in a drill, and the hills made upon it. This was a remarkably good piece of tobacco, and paid better for the outlay than any other experiment.

I have used stable (horse) manure with and without plaster in the hill for corn with beneficial results, especially so in a wet season. I consider there is but a slight difference in the yield of corn in favor of guano over this manure, but guano has the advantage in the smaller bulk to be carried to distant parts of the field and the greater rapidity and less labor in its application.

In my experiments with wheat, I have not been *very* successful, owing measurably to the advice of your contributors and farmers with whom I have conversed, as to the quantity to be used, from which the largest per centum could be realized. Taking that advice I used *it at first* too sparingly for this region to counteract the ravages of the joint-worm. From experience and observation I have learned that in this section of country, on *poor land*, unaided by other fertilizers, less than 300 lbs. Peruvian guano per acre will not pay well, and then the farmer may not calculate on much clear gain, unless he sell at high figures.

In 1853, I made a trial of one ton Peruvian guano on oats, sowed on high land, and have not since repeated the experiment; that being a dry season and the experiment consequently not succeeding well.

In dripping seasons guano acts charmingly on spring and summer crops. But the farmer will be disappointed in dry seasons, unless he be very cautious in the selection of the land for its application.

I agree with Mr. Noland, that rolling the seed corn in guano is worth the trial, if only to accelerate the growth of the young plant, so as to push it out of the way of worms and other pests; and moreover the great advantage, in my opinion is, to enable the farmer to work it earlier and get it in good order by harvest; for my little experience teaches me that in the main the working of the corn crop must cease then, unless the farmer has an extra force to keep his ploughs running in harvest time. ROBERT N. TRICE.

MYCHUNK, near Keswick Depot,
Albemarle Co.

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For the Southern Planter.

## ROLLING SEED IN GUANO.

EDITOR PLANTER:—As there seems to be some diversity of opinion as to the effects of guano upon the germination of seed when the two are brought in immediate contact, I take leave to report my experience, which has been sufficient to satisfy my own mind upon the subject. I have practiced rolling grain in guano —both corn and wheat—for several years and have always found it to act beneficially, *when the grain is planted immediately after the application is made.* Last fall, however, I had a small quantity of rolled wheat left over from the day's sowing, which remained during the night in the guano. This failed to come up—not one grain in an hundred germinating—while the rest of the crop came up well. The contact with the clay, I presume, destroys the caustic property of the guano, which otherwise, if the *article be good,* is sufficient to prevent the germination of seed. The guano I used, I purchased of Fowle & Co., of Alexandria, and proved to be a very superior article, being perfectly *dry* and giving out a strong ammoniacal smell. The guano we buy, varies as much in quality as does the whiskey we drink, (that is not *we* exactly, but some of our friends,) and the article I got last fall was as far superior to the lot sent to this county from Baltimore, as "old Bourbon" is to S. & B.'s "Blue head." Good guano is *dry* and *strong-scented*, not *wet* and *inodorous*, as is much that is offered in our market. The farmers of Virginia need no inspection of guano. They should either judge for themselves, or deal only with merchants in whom they can place confidence.

It is the business of the commission merchant to acquaint himself with the means of judging of the quality of guano, just as he learns to distinguish between good sugar and bad. The loss to the State, from the use of inferior guano, is incalculable. The first cost of the article, is as nothing compared with the failure of crop from the application of worthless guano, for it seems now that wheat will not ripen well, even upon our very best lands, without the use of this fertilizer. Our farmers should be more particular in testing the quality of guano, and think less of economising a dollar or two in the price, for they may rest assured that a good article is cheaper at $60 a ton, than some we use as a free gift. It may be true that "eggs is eggs," but it it does not follow that everything sold under the name of guano will make a wheat crop. The best tests I know are *order* and *odour*. If guano be *perfectly dry* and give out a *good strong smell*, it may be depended upon. Clean bags usually contain the best guano, as any addition of water, either from sprinkling or atmospheric absorption, shows itself in the staining of the bags.

I take occasion, while upon this subject, to mention that I have experimented in a small way with *Mexican* guano, on tobacco, corn, and wheat, alone, and mixed with Peruvian, and have yet to see the slightest effect from it. My experiments have not been made with sufficient accuracy to demonstrate to others its worthlessness, but has satisfied me that that it is not quite equal as a fertilizer to common *Ivy creek sand.*

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*From the Papers of the Nottoway Farmers' Club.*

## COMPARATIVE EXPERIMENTS WITH GUANO.

Fallowing it in and putting it in along with the Wheat—Drilled and Broadcast on Corn.

In compliance with the constitutional requisition of our club, making it obligatory upon each member to report in writing the result of some operation or experiment made during the year, I report that, in the month of August, 1853, I applied 300 pounds of guano to two acres of land then being fallo[w]ed with a two-horse plough for wheat; the r[e]mainder of the field was fallowed in the sa[me] way, but no guano was applied until Octobe[r,] the time of seeding, when about 150 lbs. p[er] acre was sown, the guano and wheat bo[th] turned under with a one-horse turning ploug[h;] a portion immediately adjoining the fir[st] mentioned two acres, and so nearly alike th[at] I could not perceive any difference. T[he] wheat was sown on both fields about the sa[me] time—perhaps the same day. The wheat [on] the first two acres was covered with a twent[y-]four tooth harrow. Throughout the seas[on] and at present the difference in favor of so[w]ing guano and wheat at the same time was four to one.

I would, as one of the committee appoint[ed] to test the value of guano applied to co[rn] broadcast at the time of planting, and on[e] half the same quantity applied in the dri[ll,] the other half broadcast at the last ploughin[g,] report that, in April, 1854, I measured tw[o] contiguous spaces of land, about 70 yar[ds] square each, of as nearly equal fertility an[d] texture as could be obtained. To one acre [I] applied $3\frac{1}{2}$ bushels (estimated to be 200 lbs[)] guano broadcast, and turned it in with a on[e-]horse plough; to the other acre I applied [...] bushels guano in the drill at the time of plan[t]ing. The drills were opened by throwing o[ut] one furrow each way with the single ploug[h,] the guano sown in the drill and closed [by] throwing back two furrows with the sa[me] plough. The drills for planting were open[ed] with a trowel hoe—both pieces planted t[he] same day and in the same way, except [as] above—the land inclining to sandy. At t[he] last ploughing of the corn, I applied $1\frac{3}{4}$ bus[h]els guano broadcast to the drilled acre—wo[rk] done with the cultivator. The broadcast ac[re] produced 4 barrels, 4 bushels and 3-16 of [a] bushel. The drilled acre, 4 barrels and [...] bushels corn. Both acres in all respec[ts] alike, planted at the same time, worked on t[he] same days and with the same implemen[ts.] Both suffered from drought, as did the re[st] of my crop. Wm. R. Bland.

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Best Mode of applying Guano to Corn.

Mr. President: In accordance with a r[e]quest of the club, the following experimen[ts] were made with guano on corn, in order to a[s]certain the best mode of its application.

I selected four acres of thin land, about t[he] same quality. On the first I applied 200 l[bs.] of guano broadcast, and turned it under t[he] 1st of March with a double plough.

On the second acre, I applied 200 lbs. guano in the drill, in the following way: The land having been previously fallowed with a double plough, furrows were made at the time of planting by running twice in a place with a single plough, in which the guano was drilled; a harrow was then run over it, which covered it two or three inches deep; the corn was then dropped and covered with harrows.

On the third acre, I used no guano.

On the fourth, I applied 100 lbs. of guano in the drill, in the same way as on the second acre; and at the second ploughing I applied 100 lbs. in furrows made by a single plough on each side of the corn, and covered with single ploughs. The results were as follows:

| | |
|---|---|
| 1st acre, 200 lbs. broadcast, produced 4 barrels, 4 bushels, and 3 pecks, at $3 50, | $17 44 |
| 2d acre, 200 lbs. in the drill, produced 3 bbls., 4 bushels, and 3 pecks, at $3 50, | 13 95 |
| 3d acre, nothing used, produced 1 bbl., 4 bushels, and 2 pecks, at $3 50, | 6 75 |
| 4th acre, 100 lbs. in drill and 100 lbs. at side, produced 5 bbls., 2 bushels, and 1 peck, at $3 50, | 19 16 |

In the above there is nothing said about short corn, as it was put at half price, and carried out in the estimate of each acre.

By adding to the product of the unimproved acre, which was $6 75, the cost of guano and interest thereon for one year, (say $5 30) and deducting the amount, $12 05, from the product of the first acre. the remainder ($5 39) will show the profit by the use of guano, applied broadcast. In the same way, $1 90 is the profit by its use in the drill, and $7 11 is the profit by its use as applied on the fourth acre.

But in order to ascertain more accurately the profits by the use of guano, we should charge for cultivation, which I will put down down at $5 per acre, which is moderate, supposing the laborer to find himself and horse; also $5 30 per acre for guano when used. By this estimate, it will be found that the nett profit on the unimproved acre is $1 75; on the 1st acre, $7 14; on 2nd, $3 65; and on the 4th, $8 86. The result of the above experiments is decidedly in favor of using half the guano in the drill at the time of planting, and half at the second ploughing. I will state, in connection with these experiments, that the corn on the acre on which the guano was applied broadcast, looked decidedly better than any other until it was about three feet high, about which time that on the acre on which the 200 lbs. guano was used in the drill, overtook it. This acre, during the summer, and even after the tops were cut, I thought would have produced at least a barrel more than any other, but to my surprise I found the 4th acre produced the most. This is an exemplification of the fallacy of judging as to the results of experiments by the eye.

Respectfully submitted.

WM. IRBY.

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COMPARATIVE EFFECTS OF 300, 200, AND 100 LBS. OF GUANO ON AN ACRE OF CORN.

As one of a committee of three appointed to make experiments with guano upon corn, I have performed, very satisfactorily to myself, the duty assigned me by the club, and hereby report the results to which I have come.

The object of the experiments was, to test the comparative effects of 300 lbs., 200 lbs., and 100 lbs. of guano, on an acre of corn.

Being unfavorably situated, however, for executing my task, I have conducted the experiments only in a *pro rata* form; that is, a half acre of ground was selected and divided into four parts, or lots, each containing five rows of corn.

As late as about the 15th of May last, this plot of ground, which was poor and had been seeded to oats with guano the year before, was thrown into 5 feet beds with the single dagon, and planted with corn at 2 feet distance. Before fallowing, three of the lots had been dressed respectively with 38 lbs., 25 lbs., and and 13 lbs. of guano each, while the fourth lot was left undressed, for comparison.

Besides being planted late, the crop was badly worked. It suffered, also, from the depredations of birds, especially the lot which was undressed—being an outside one, and remotest from the houses.

On the 30th of November, the corn was gathered and measured, as follows, (at the rate per acre:)

| | Lbs. guano. | Bbls. | Bush. | |
|---|---|---|---|---|
| 1st acre, | 300 | 2 | 4, | exclusive of nubbins. |
| 2d acre, | 200 | 2 | 2, | " " |
| 3d acre, | 100 | 2 | – | " " |
| 4th acre, | – | – | 4, | " " |

Estimating corn to be worth $3 50 per barrel, and putting guano at $50 per ton, we arrive at the following results in gain and loss. Deducting in each case four bushels as the unaided product of the land.

| | Bbls. | Value. | Cost of guano. | Gain. | Loss. |
|---|---|---|---|---|---|
| 1st acre, | 2 | $7 | $7 50 | | 50 cts. |
| 2d acre, | 1 3-5 | 5 60 | 5 00 | 60 cts. | |
| 3d acre, | 1 1-5 | 4 20 | 2 50 | $1 70 | |

On giving credit to the guano only for the increased crop produced by it, and allowing 1 barrel per acre to the unaided powers of the land, the result will be:

| | | |
|---|---|---|
| 1st acre, | loss, | $4 00 |
| 2d acre, | " | 2 10 |
| 3d acre, | " | 1 80 |

Respectfully submitted.

*Nottoway, April* 12, '55. G. FITZGERALD.



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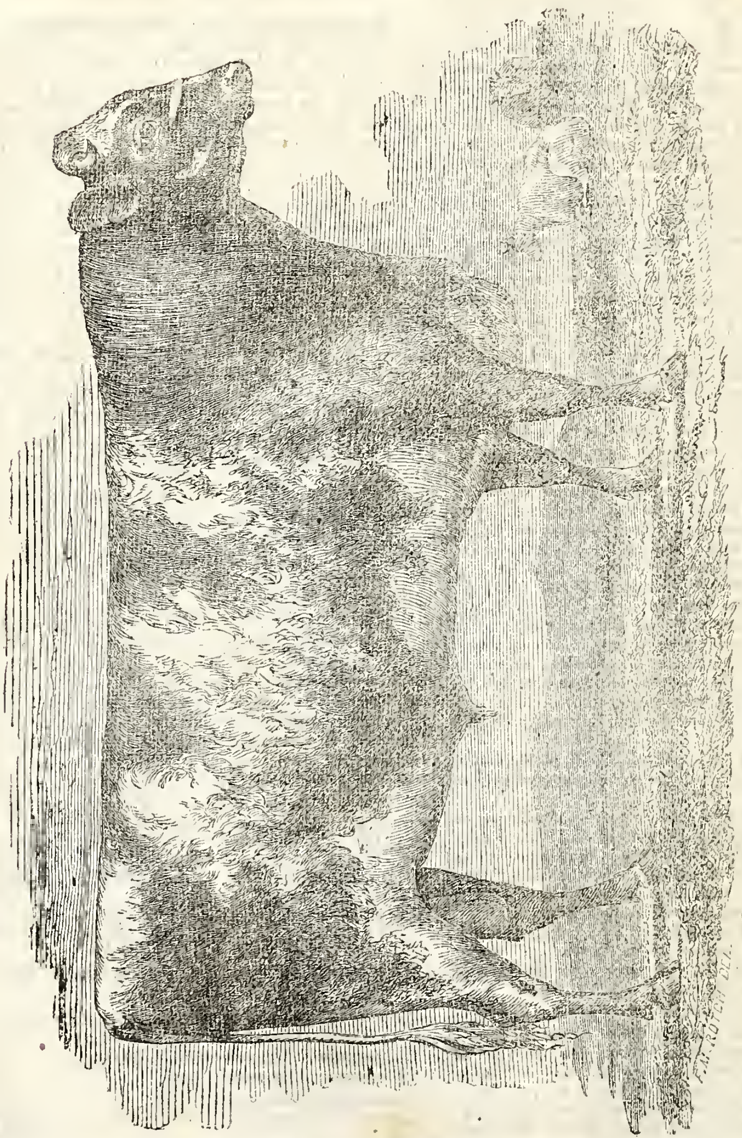
LIST OF PAYMENTS

*From 1st to 19th March*, 1856.

| | |
|---|---|
| S S Alsop, Jan 1857 | 1 00 |
| Dr W T Banks, Jan 1857 | 1 00 |
| Wm Hill, Oct 1856 | 3 50 |
| B Hiner, Jan 1857 | 2 00 |
| J A Montague, Jan 1857 | 1 00 |
| T H Montague, Jan 1857 | 1 00 |
| Jos C Eubank, Jan 1857 | 1 00 |
| W A Street, Jan 1857 | 1 00 |
| W C Stribling, Jan 1857 | 1 00 |
| Gen W H Richardson, Jan 1857 | 1 00 |
| A E Smithe, July 1856 | 2 00 |
| H Handley, Apr 1857 | 2 00 |
| R V Lockhart, July 1859 | 5 00 |
| Geo Johnson, Nov 1856 | 1 00 |
| Jas C Kasey, Jan 1857 | 1 00 |
| Dr G G Minor, Jan 1857 | 1 00 |
| C H Winfree, Jan 1857 | 1 00 |
| W W Harris, Jan 1857 | 1 00 |
| D B M'Gehee, Mar 1857 | 1 00 |
| L A Crenshaw, Jan 1857 | 1 00 |
| W P Waugh, Jan 1857 | 1 00 |
| Dr W E Dodson, Jan 1857 | 2 30 |
| Dr T B Anderson, Jan 1857 | 1 00 |
| O Moore, Jan 1857 | 1 00 |
| B W Bellamy, Jan 1857 | 1 00 |
| R T Pleasants, Jan 1857 | 1 00 |
| Dr R Wood, Mar 1856 | 3 90 |
| W Frazier, July 1856 | 1 25 |
| W F Barner, Jan 1857 | 1 00 |
| Sam'l A Grinter, Jan 1857 | 1 00 |
| J E Smith, July 1856 | 1 25 |
| L Burruss, Jan 1857 | 1 00 |
| A Meandon, Jan 1857 | 1 00 |
| A Pointer, Jan 1858 | 2 00 |
| E Cunningham, Jan 1857 | 1 00 |
| W H Roy, Jan 1856 | 1 00 |
| T L Hundley, Jan 1857 | 1 00 |
| Jno W Paxton, Jan 1857 | 1 00 |
| Col Geo Townes, Jan 1861 | 5 00 |
| Jno N Griffin June 1856 | 1 00 |
| O C Fowler, Jan 1857 | 1 00 |
| Jas D Gibson, Jan 1857 | 3 25 |
| Jno N Ryland, Jan 1857 | 1 00 |
| W D Blanton, Oct 1856, | 1 25 |
| Jos Janney, July 1856 | 6 25 |
| W Logan, Jr Jan 1857 | 2 00 |
| Col W Rison, Jan 1857 | 2 50 |
| S Gouldin, Jan 1857 | 2 00 |
| W F Lewis, Jan 1857 | 3 00 |
| Jno Phillips, | 1 00 |
| W F Hobbs, July 1857 | 1 00 |
| W R Scarlett, Jan 1857 | 2 00 |
| S Dickson, Jan 1856 | 2 00 |
| Joe Reunie, Jan 1857 | 3 00 |
| S B Major, Apr 1856 | 1 50 |
| J P Cocke, Jan 1857 | 1 00 |
| J Michaux, Jan 1857 | 1 00 |
| F B Welton, Jan 1857 | 1 00 |

| | |
|---|---|
| C C Hightower, Jan 1857 | 1 00 |
| E Hancock, Feb 1857 | 1 00 |
| L H B Whitaker, Jan 1857 | 1 00 |
| W J Lawrence, Jan 1857 | 1 00 |
| M Cason, Jan 1857 | 1 00 |
| W Turnbull, Nov 1855 | 2 50 |
| S L Lewis Jan 1857 | 1 00 |
| Rev P Cleaveland, Jan 1857 | 1 00 |
| J H Carrington, Jan 1857 | 1 75 |
| Mrs L P Miller, Jan 1857 | 1 00 |
| R C L Moncure, Jan 1857 | 2 00 |
| R L Rudasilla, Jan 1857 | 1 00 |
| Jas Harding, Feb 1857 | 1 00 |
| R Hurst, Feb 1857 | 1 00 |
| T Dunaway, Feb 1857 | 1 00 |
| C Harding, Feb 1857 | 1 00 |
| TH Pinckard, Feb 1857 | 1 00 |
| Dav Graham, Jan 1860 | 10 00 |
| J M Fray, July 1854 | 2 00 |
| R B Burruss, Jan 1857 | 1 00 |
| Dan'l Jones, Jan 1857 | 1 00 |
| J B Whitehead, Jan 1857 | 1 00 |
| A Phillips, Jan 1857 | 2 00 |
| J W Reese, July 1856 | 5 00 |
| J D Massenburg, Jan 1857 | 1 00 |
| A J Greene, Apr 1857 | 3 00 |
| R Robinson, Jan 1857 | 3 00 |
| S D Watkins, Jan 1857 | 1 00 |
| Jno F Lynk, Apr 1856 | 2 50 |
| S P Mitchell, Jan 1857 | 1 00 |
| Maj C Yancey, Jan 1857 | 1 50 |
| S Petty, Jan 1856 | 2 00 |
| A R Stringer, July 1856 | 1 25 |
| W P Tatum, Jan 1857 | 1 00 |
| S Rixey, jr Jan 1857 | 1 00 |
| T Michaux, Jan 1857 | 1 83 |
| Capt T Nelson, Jan 1857 | 1 00 |
| L N Davis, Jan 1857 | 1 00 |
| S B Jones, Jan 1857 | 1 33 |
| J M Taylor, Jan 1857 | 1 00 |
| J F Greenlee, June 1856 | 2 50 |
| R J Davis, Jan 1857 | 1 00 |
| Judge W Daniel, jr Jan 1857 | 4 00 |
| T B Robertson, Jan 1857 | 2 25 |
| A W Womack, Jan 1857 | 1 00 |
| N Piggott, Jan 1857 | 1 00 |
| Jno C Bell, Jan 1857 | 2 58 |
| R Wilkinson, Jan 1857 | 2 00 |
| T J Hoduet, Jan 1857 | 2 00 |
| S C Townes, Jan 1857 | 2 00 |
| C T Sutherlin, Jan 1857 | 1 17 |
| W Woodson, Jan 1857 | 1 00 |
| R N Hudson, April 1857 | 1 00 |
| W S Carter, Jan 1857 | 2 00 |
| W B Aston, July 1856 | 3 50 |
| W C Rives, jr. Jan 1857 | 3 00 |
| V Markham, Jan 1857 | 1 00 |
| R L Walker, Jan 1857 | 1 00 |
| H L Opie, Sept 1856 | 3 75 |
| A W Cousins, Jan 1857 | 1 00 |
| W C Carrington Jan 1857 | 2 00 |

| | |
|---|---|
| Jas M M'Gargo, March 1857 | 1 |
| Gen W T Ballew, Jan 1857 | 3 |
| W Dupuy, Jan 1857 | 1 |
| J H Knight, Jan 1857 | 1 |
| R V Watkins, Jan 1857 | 1 |
| J J Scott, Dec 1856 | 1 |
| B S Scott, Nov 1856 | 1 |
| F P Wood, April 1857 | 1 |
| J D Ligon, May 1857 | 1 |
| Jas W Walker, July, 1856 | 2 |
| Maj J H Lee, July 1857 | 5 |
| G Hairston, sr Jan 1857 | 1 |
| L Hundley, Jan 1857 | 1 |
| J J Ewin, Jan 1857 | 1 |
| Dr C M'Dowell, Jan 1857 | 1 |
| T E Shannon, Jan 1857 | 1 |
| Dr G S Newman, Jan 1857 | 1 |
| Jno Grasty, Jan 1857 | 2 |
| E R Coke, Jan 1857 | 1 |
| Dr T J Williams, Jan 1857 | 1 |
| J S Quisenberry, Jan 1858 | 3 |
| F Jones, July 1857, | 3 |
| J Y Hardy, Apr 1856 | 1 |
| G R Trant, Jan 1857 | 1 |
| W B B Walker, Jan 1856 | 1 |
| Jos Rock, Jan 1857 | 2 |
| Col T J Randolph, Jan 1856 | 5 |
| A G Moody, Jan 1857 | 2 |
| K S Nelson, Jan 1857, | 3 |
| Dr C D Everett, Jan 1857 | 8 |
| Mrs S J Colston, Sep 1856 | 3 |
| Wm Eddins, Apr 1857 | 1 |
| J W Mason, Jan 1857 | 1 |
| R Gwathmey, Jan 1857 | 3 |
| W C Tucker, Jan 1857 | 1 |
| H W Ashton, Jan 1857 | 2 |
| R H Carter, Jan 1857 | 2 |
| J Ferneyhough, Jan 1857 | 1 |
| Jos Alsop, Jan 1857 | 1 |
| A P Rowe, Jan 1857 | 1 |
| Thos Yerby, Jan 1857 | 4 |
| Wm Carter, Jan 1857 | 2 |
| C Morgan, March 1857 | 1 |
| M Wallace, Jan 1857 | 3 |
| A H H Bernard, Mar 1856 | 2 |
| A P Strother, Jan 1859 | 5 |
| A G Binford, Jan 1857 | 1 |
| R L Brown, Jan 1857 | 1 |
| Geo Jones, April 1856 | 1 |
| E C Turner, Jan 1857 | 2 |
| W J Webb, April 1856 | 1 |
| M R H Garnet, Jan 1858 | 6 |
| Jos H Howe, April 1856 | 1 |
| Jno Sclater, Jan 1857 | 1 |
| E T Douglass, March 1857 | 1 |
| Col T Brown, January 1856 | 1 |
| L C Berkeley, April 1856 | 3 |
| B L Cason, March 1857 | 1 |



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