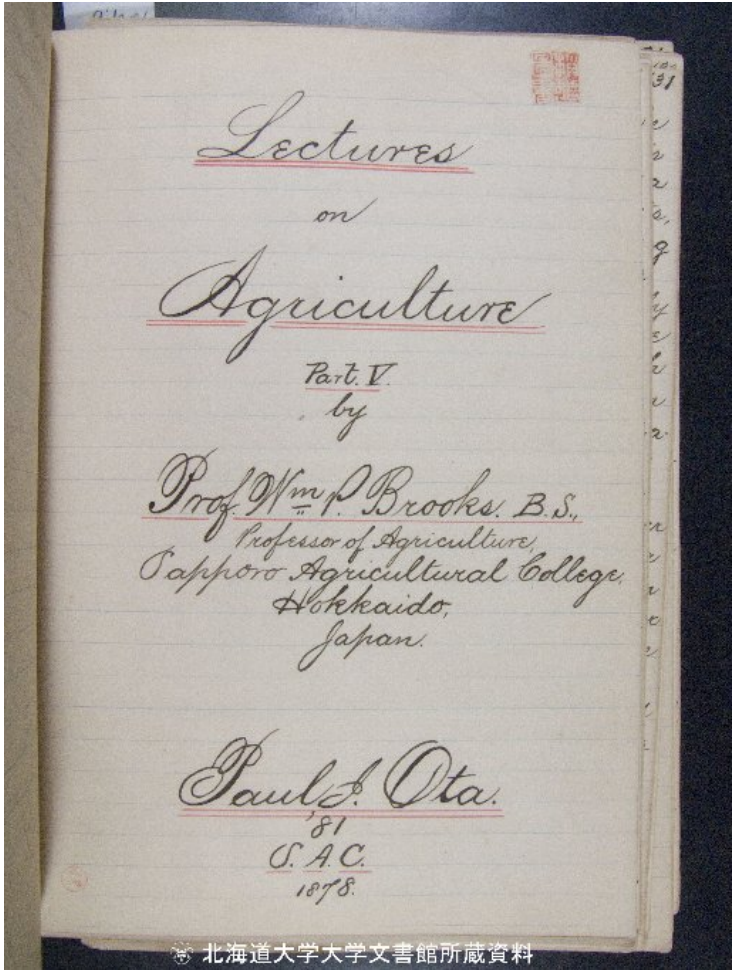

Lectures

on

Agriculture

Part V.

by

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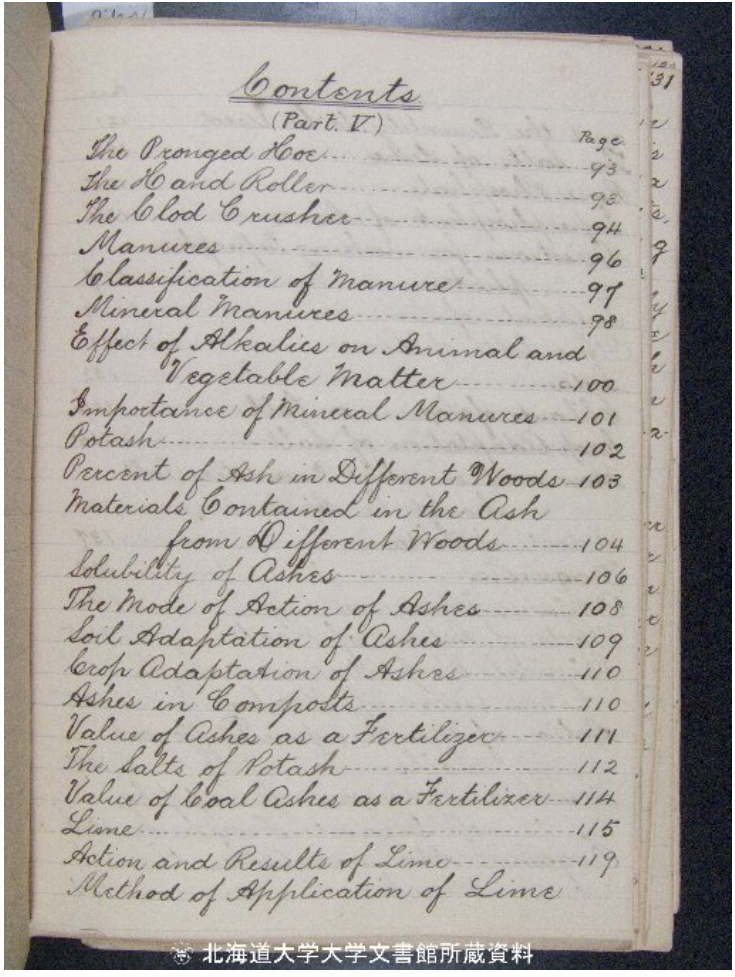

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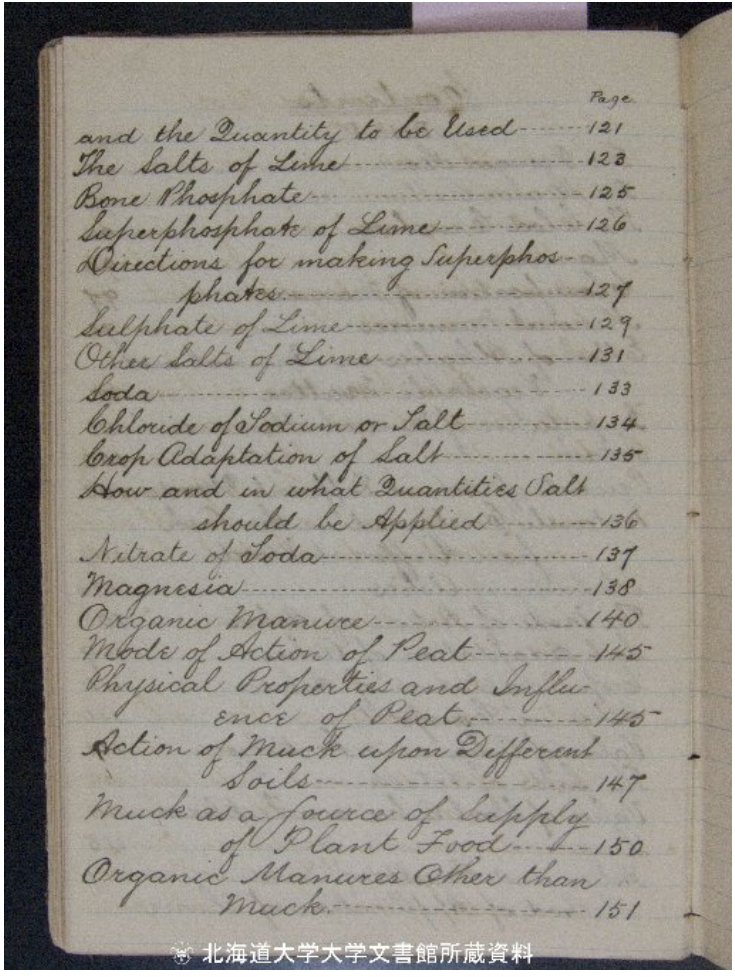

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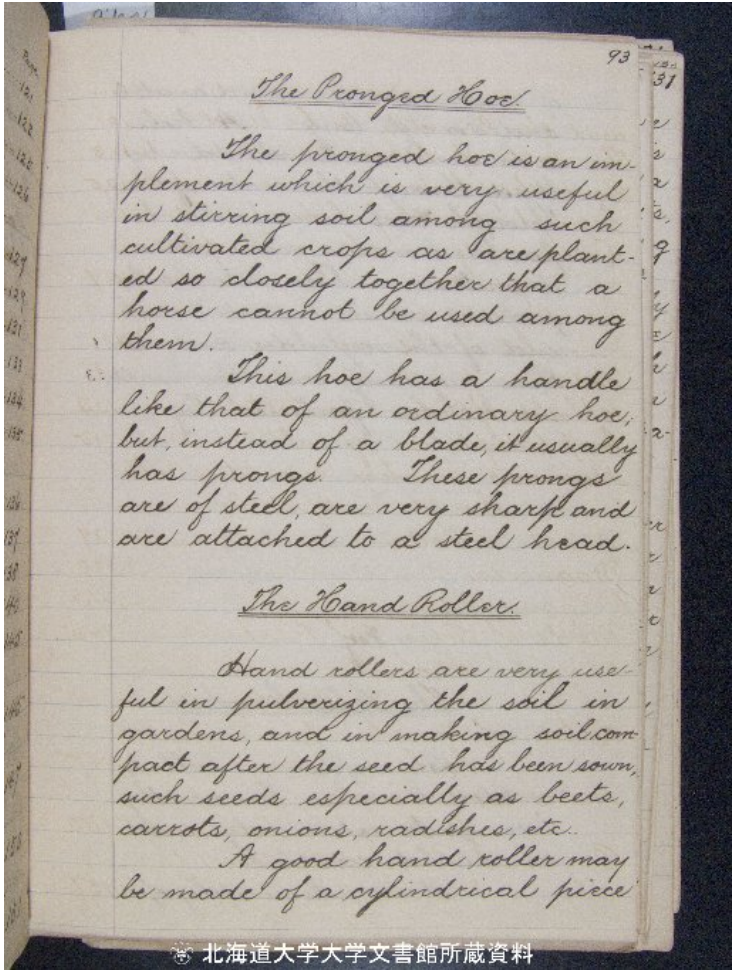


The Pronged Hoe.

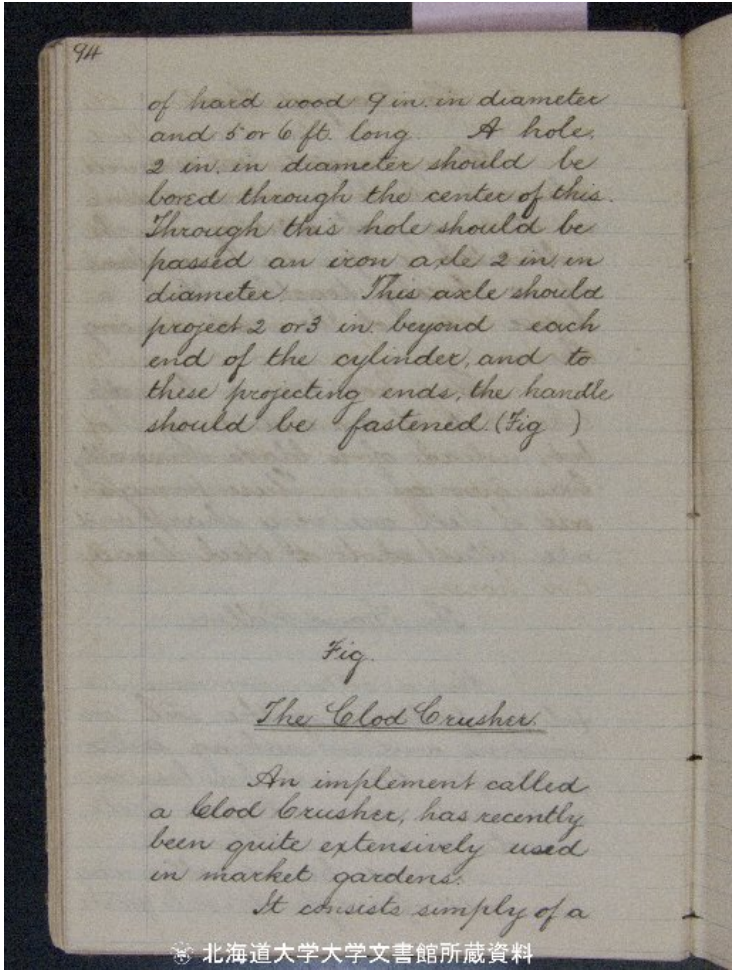
The pronged hoe is an inplement which is very useful in stirring soil among such cultivated crops as are planted so closely together that a horse cannot be used among them.

This hoe has a handle like that of an ordinary hoe; but, instead of a blade, it usually has prongs. These prongs are of steel, are very sharp and are attached to a steel head.

The Hand Roller.

Hand rollers are very useful in pulverizing the soil in gardens, and in making soil compact after the seed has been sown, such seeds especially as beets, carrots, onions, radishes, etc..

A good hand roller may be made of a cylindrical piece



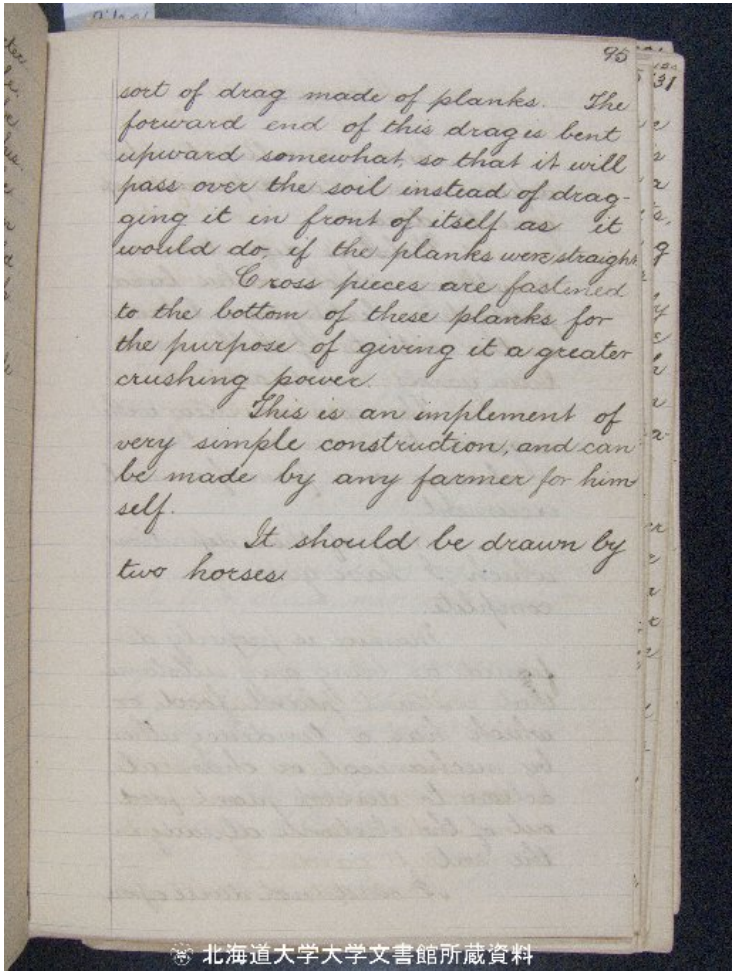
of hard wood 9 in. in diameter and 5 or 6 ft. long. A hole, 2 in. in diameter should be bored through the center of this. Through this hole should be passed an iron axle 2 in. in diameter. This axle should project 2 or 3 in. beyond each end of the cylinder, and to these projecting ends, the handle should be fastened. (Fig.)

Fig.

The Clod Crusher.

An implement called a Clod Crusher, has recently been quite extensively used in market gardens.

It consists simply of a

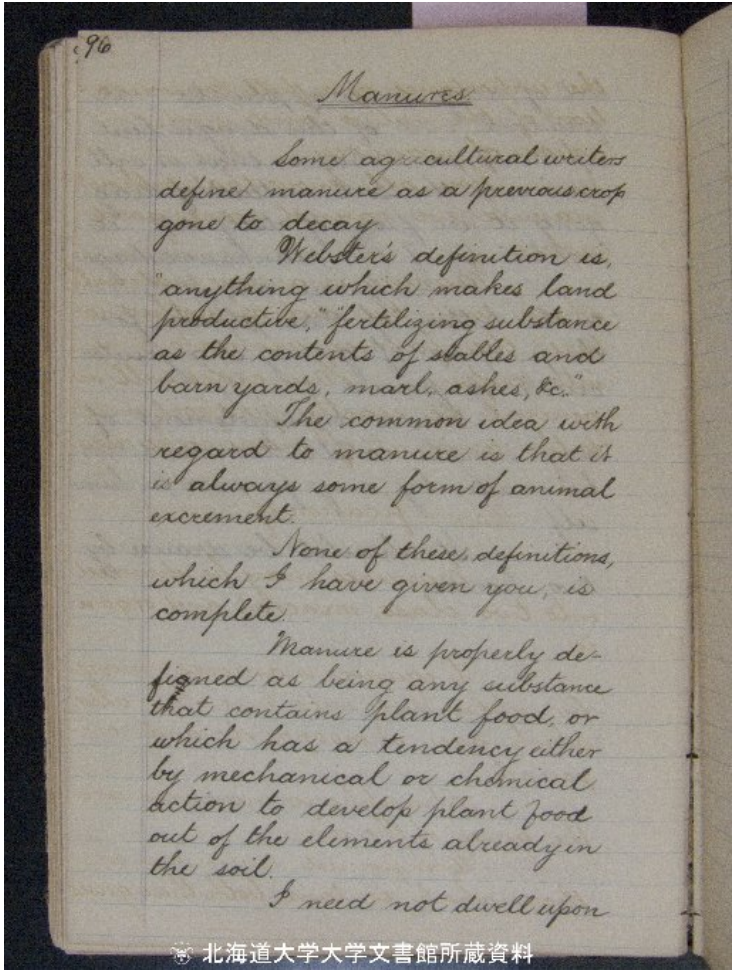


sort of drag made of planks. The forward end of this drag is bent upward somewhat, so that it will pass over the soil instead of dragging it in front of itself as it would do, if the planks were straight.

Cross pieces are fastened to the bottom of these planks for the purpose of giving it a greater crushing power.

This is an implement of very simple construction, and can be made by any farmer for himself.

It should be drawn by two horses.



Manures.

Some agricultural writers define manure as a previous crop gone to decay.

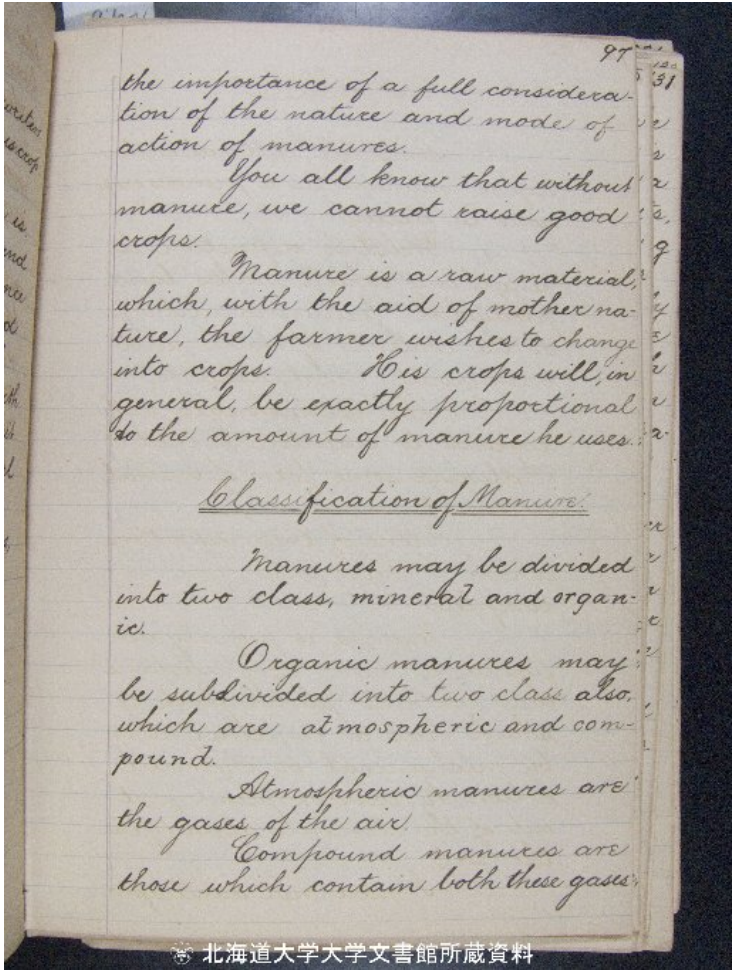
Webster's definition is, "anything which makes land productive", "fertilizing substance as the contents of stables and barn yards, marl, ashes, &c.".

The common idea with regard to manure is that it is always some form of animal excrement.

None of these, definitions, which I have given you, is complete.

Manure is properly defined as being any substance that contains plant food, or which has a tendency either be mechanical or chemical action to develop plant food out of the elements already in the soil.

I need not dwell upon



the importance of a full consideration of the nature and mode of action of manures.

You all know that without manure, we cannot raise good crops.

Manure is a raw material, which, with the aid of mother nature, the farmer wishes to change into crops. His crops will, in general, be exactly proportional to the amount of manure he uses.

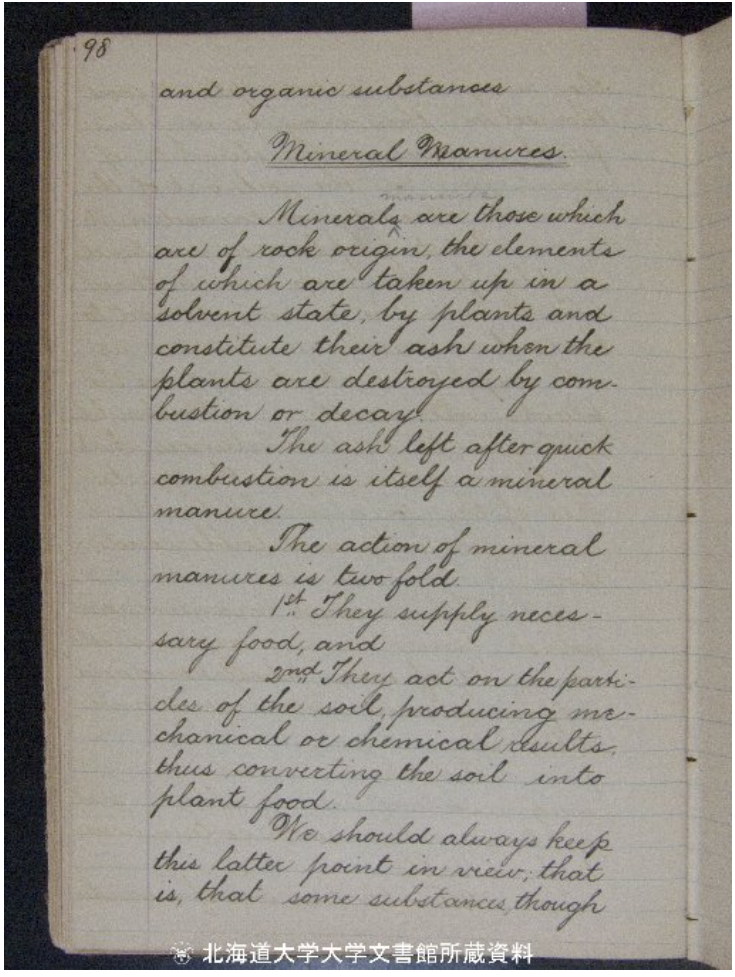
Classification of Manure.

Manures may be divided into two class, mineral and organic.

Organic manures may be subdivided into two class also, which are atmospheric and compound.

Atmospheric manures are the gases of the air.

Compound manures are those which contain both these gases



and organic substances.

Mineral Manures.

Minerals manures are those which are of rock origin, the elements of which are taken up in a solvent state, by plants and constitute their ash when the plants are destroyed by combustion or decay.

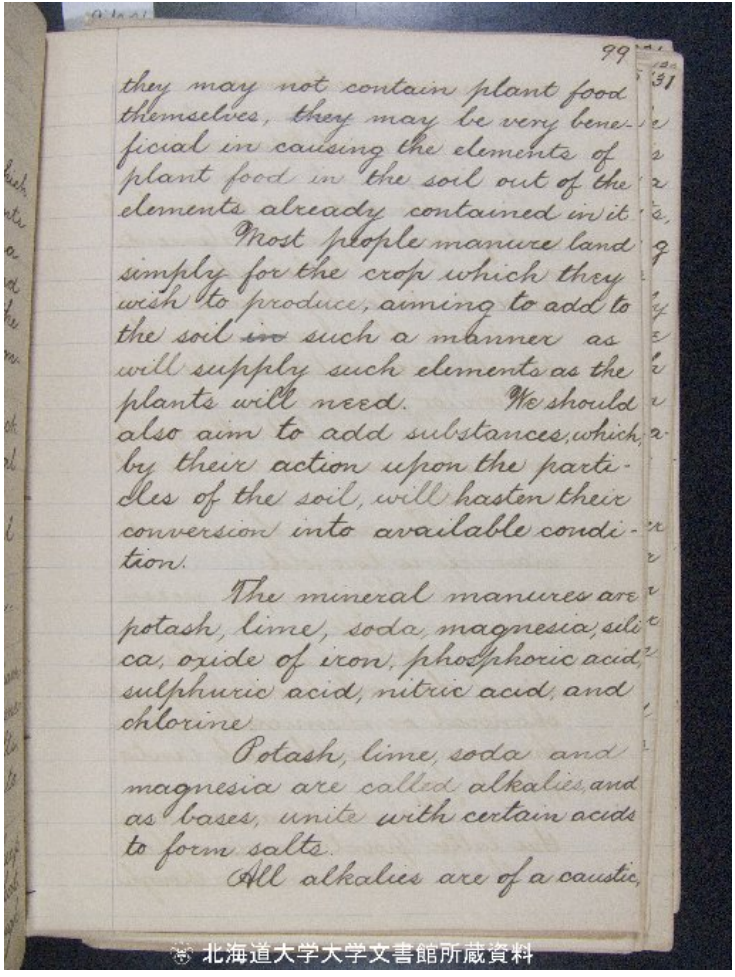
The ash left after quick combustion is itself a mineral manure.

The action of mineral manures is two fold.

1st They supply necessary food, and

2nd They supply act on the particles of the soil, producing mechanical or chemical results, thus converting the soil into plant food.

We should always keep the latter point in view; that is, that some substances, though



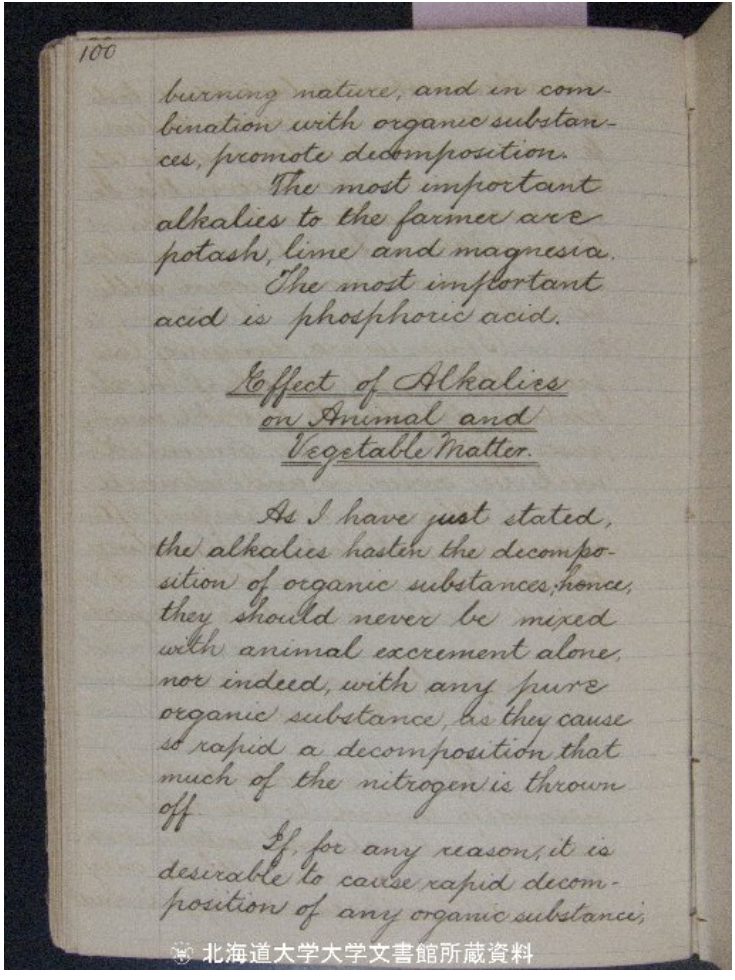
they may not contain plant food themselves, they may be very beneficial in causing the elements of plant food in the soil out of the elements already contained in it.

Most people manure land simply for the crop which they wish to produce, aiming to add to the soil such a manner as will supply such elements as the plants will need. We should also aim to add substances, which, by their action upon the particles of the soil, will hasten their conversion into available condition.

The mineral manures are potash, lime, soda, magnesia, silica, oxide of iron, phosphoric acid, sulphuric acid, nitric acid, and chlorine.

Potash, lime, soda and magnesia are called alkalies, and as bases, unite with certain acids to form salts.

All alkalies are of a caustic,



burning nature, and in combination with organic substances, promote decomposition.

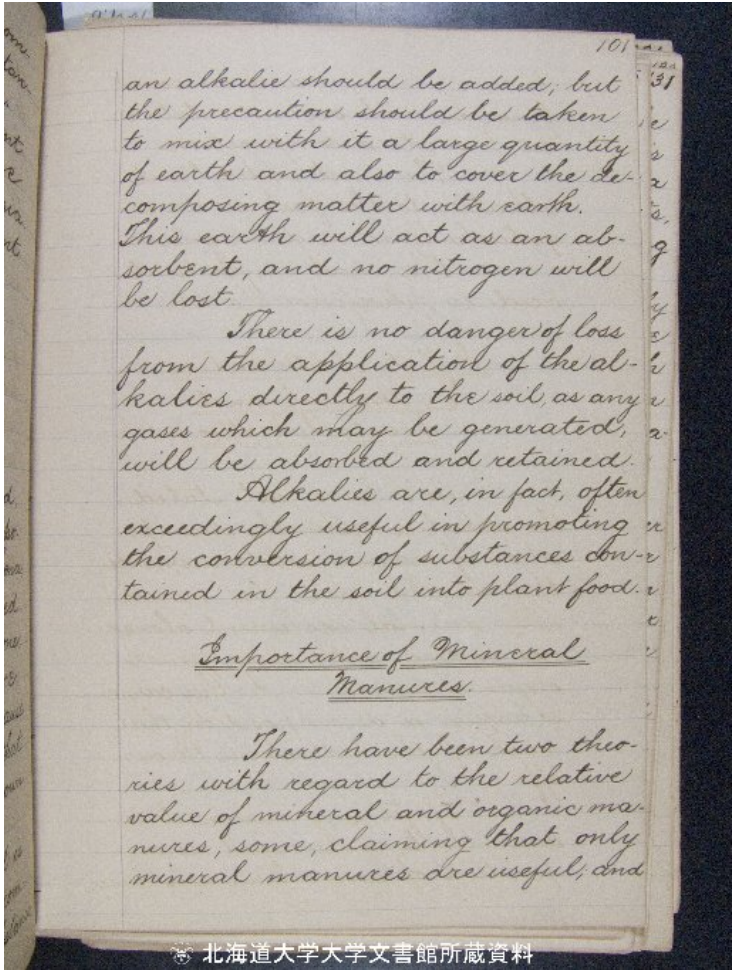
The most important alkalies to the farmer are potash, lime and magnesia.

The most important acid is phosphoric acid.

Effect of Alkalies on Animal and Vegetable Matter.

As I have just stated, the alkalies hasten the decomposition of organic substances; honce, they should never be mixed with animal excrement alone, not indeed, with any pure organic substance, as they cause so rapid a decomposition that much of the nitrogen is thrown off.

If, for any reason, it is desirable to cause rapid decomposition of any organic substance,



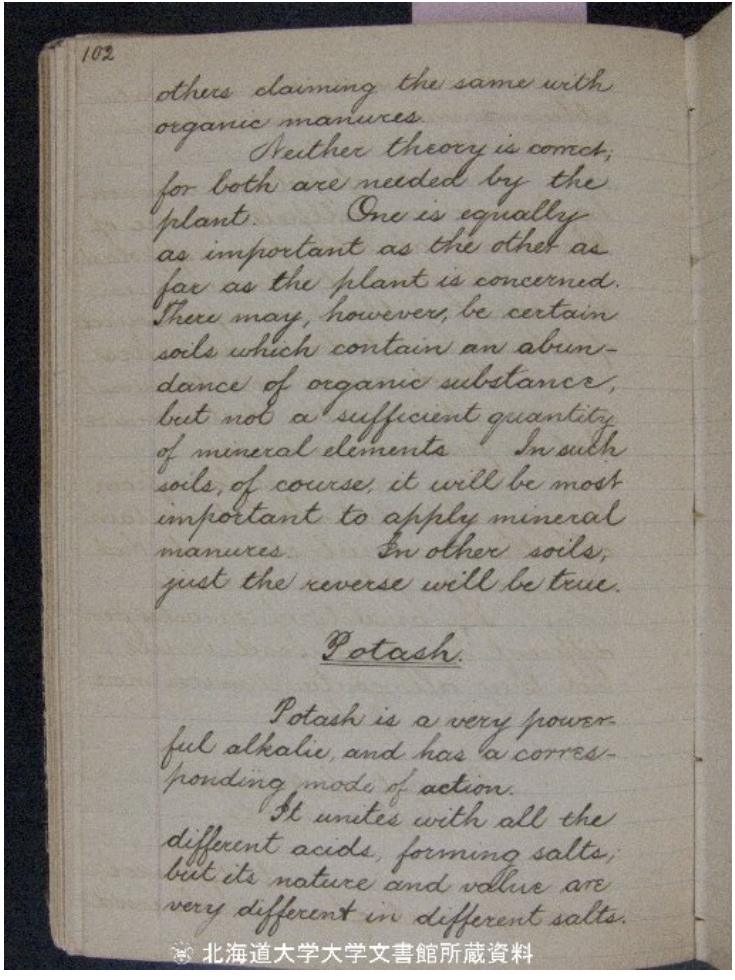
an alkalie should be added, but the precaution should be taken to mix with it a large quantity of earth and also to cover the decomposing matter with earth. This earth will act as an absorbent, and no nitrogen will be lost.

There is no danger of loss from the application of the alkalies directly to the soil, as any gases which may be generated, will be absorbed and retained.

Alkalies are, in fact, often exceedingly useful in promoting the conversion of substances contained in the soil into plant food.

Importance of Mineral Manures.

There have been two theories with regard to the relative value of mineral and organic manures, some, claiming that only mineral manures are useful; and



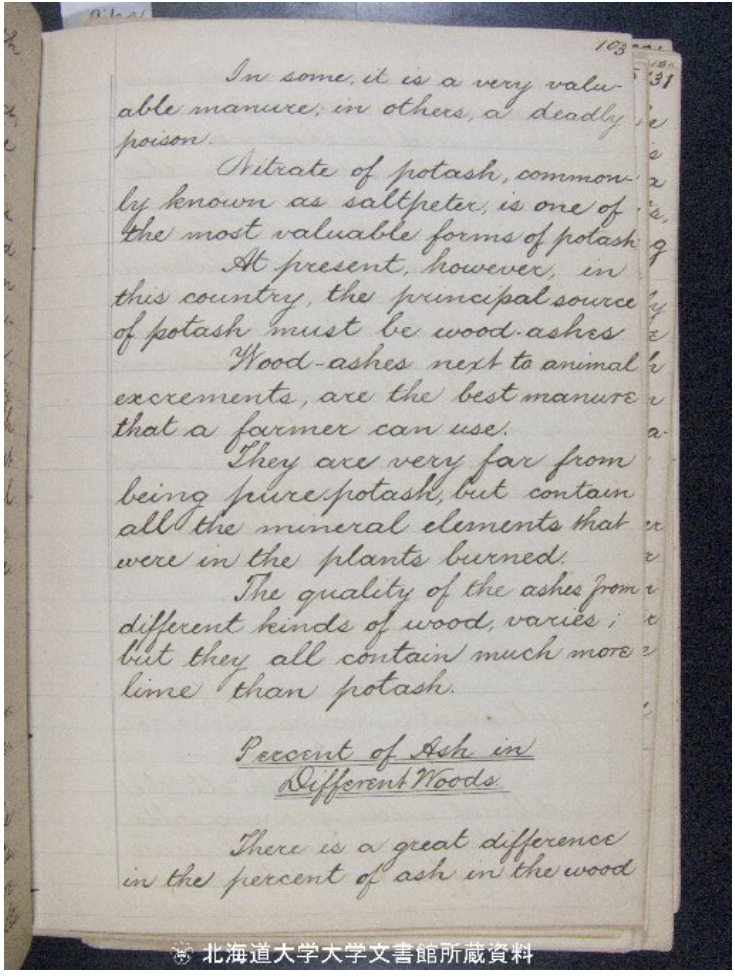
other claiming the same with organic manures.

Neither theory is correct; for both are needed by the plant. One is equally as important as the other as far as the plant is concerned. There may, however, be certain soils which contain an abundance of organic substance, but not a sufficient quantity of mineral elements. In such soils, of course, it will be most important to apply mineral manures. In other soils, just the reverse will be true.

Potash.

Potash is a very powerful alkalie, and has a corresponding mode of action.

It unites with all the different acids, forming salts; but its nature and value are very different in different salts.



In some, it is a very valuable manure; in others, a deadly poison.

Nitrate of potash, commonly known as saltpeter, is one of the most valuable forms of potash.

It present, however, in this country, the principal source of potash must be wood-ashes.

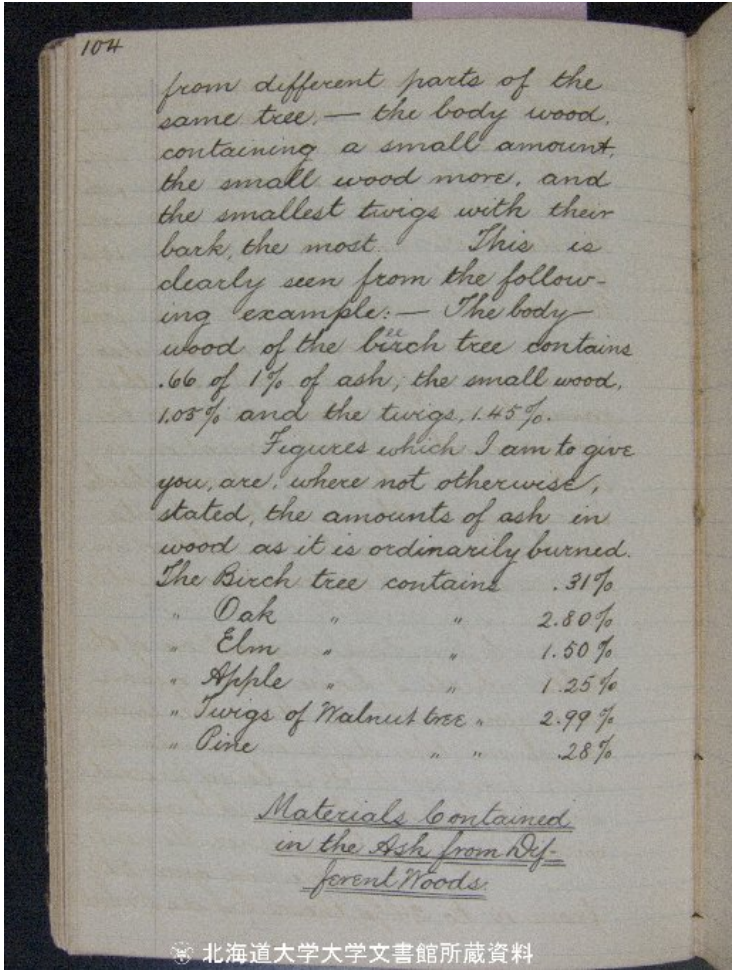
Wood-ashes next to animal excrements, are the best manure that a farmer can use.

They are very far from being pure potash, but contain all the mineral elements that were in the plants burned.

The quality of the ashes from different kinds of wood, varies, but they all contain much more lime than potash.

Percent of Ash in
Different Woods.

There is a great difference in the percent of ash in the wood

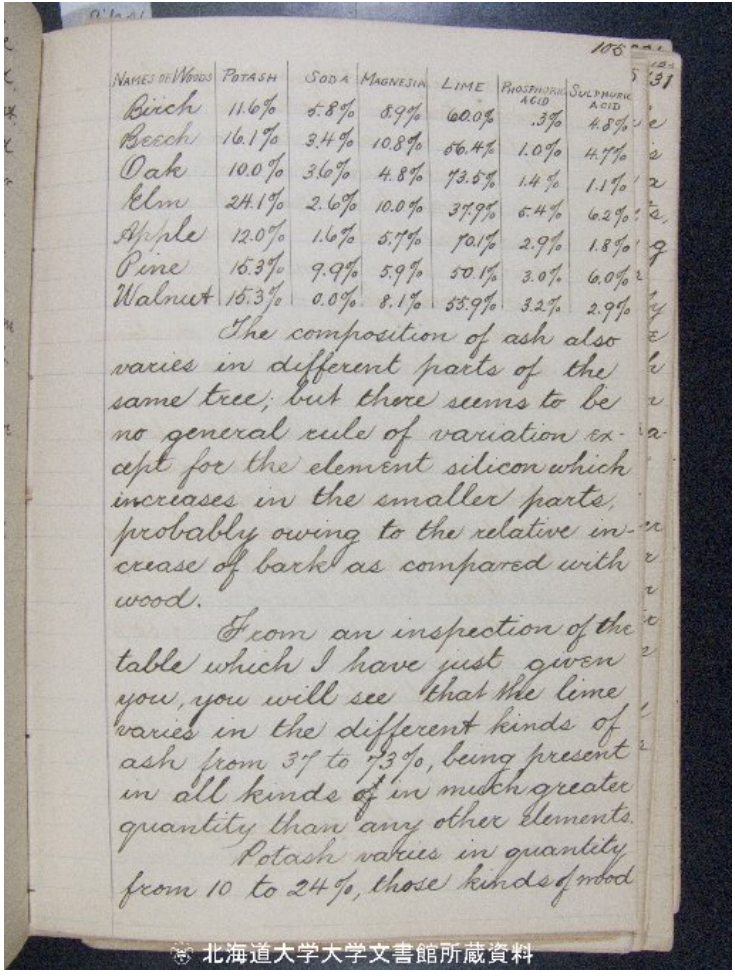


from different parts of the same tree. —— the body wood, containing a small amount, the small wood more, and the smallest twigs with their bark, the most. This is clearly seen from the following example: —— The body wood of the beech tree contains .66 of 1% of ash; the small wood, 1.05% and the twigs, 1.45%.

Figures which I am to give you, are, where not otherwise, stated, the amounts of ash in wood as it is ordinarily burned.

The Birch tree contains	.31%
〃 Oak 〃 〃	2.80%
〃 Elm 〃 〃	1.50%
〃 Apple 〃 〃	1.25%
〃 Twigs of Walnut tree 〃	2.99%
〃 Pine 〃 〃	.28%

Materials Contained in the Ash from Different Woods.

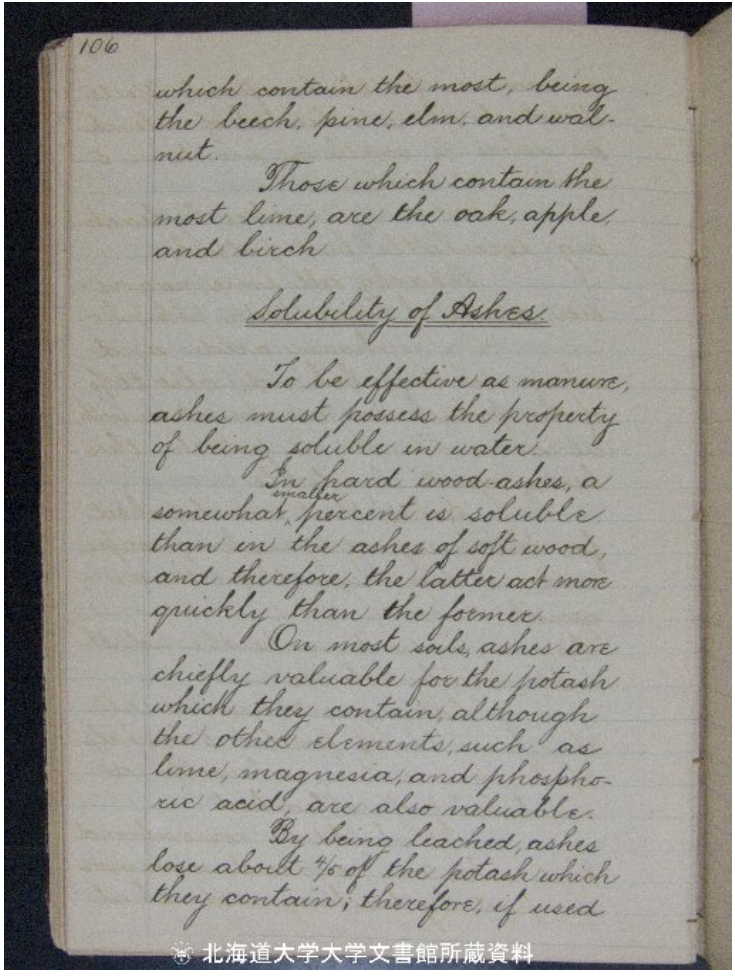


NAMES OF WOODS	POTASH	SODA	MAGNESIA	LIME	PHOSPHORIC ACID	SULPHURIC ACID
Birch	11.60%	5.80%	8.90%	60.00%	0.30%	4.80%
Beech	16.10%	3.40%	10.80%	56.40%	1.00%	4.70%
Oak	10.00%	3.60%	4.80%	73.50%	1.40%	1.10%
Elm	24.10%	2.60%	10.00%	37.90%	5.40%	6.20%
Apple	12.00%	1.60%	5.70%	70.10%	2.90%	1.80%
Pine	15.30%	9.90%	5.90%	50.10%	3.00%	6.00%
Walnut	15.30%	0.00%	8.10%	55.90%	3.20%	2.90%

The composition of ash also varies in different parts of the same tree; but there seems to be no general rule of variation except for the element silicon which increases in the smaller parts, probably owing to the relative increase of bark as compared with wood.

From an inspection of the table which I have just given you, you will see that the lime varies in the different kinds of ash from 37 to 73%, being present in all kinds in much greater quantity than any other elements.

Potash varies in quantity from 10 to 24%, those kinds of mood



which contain the most, being the beech, pine, elm, and walnut.

Those which contain the most lime, are the oak, apple, and birch.

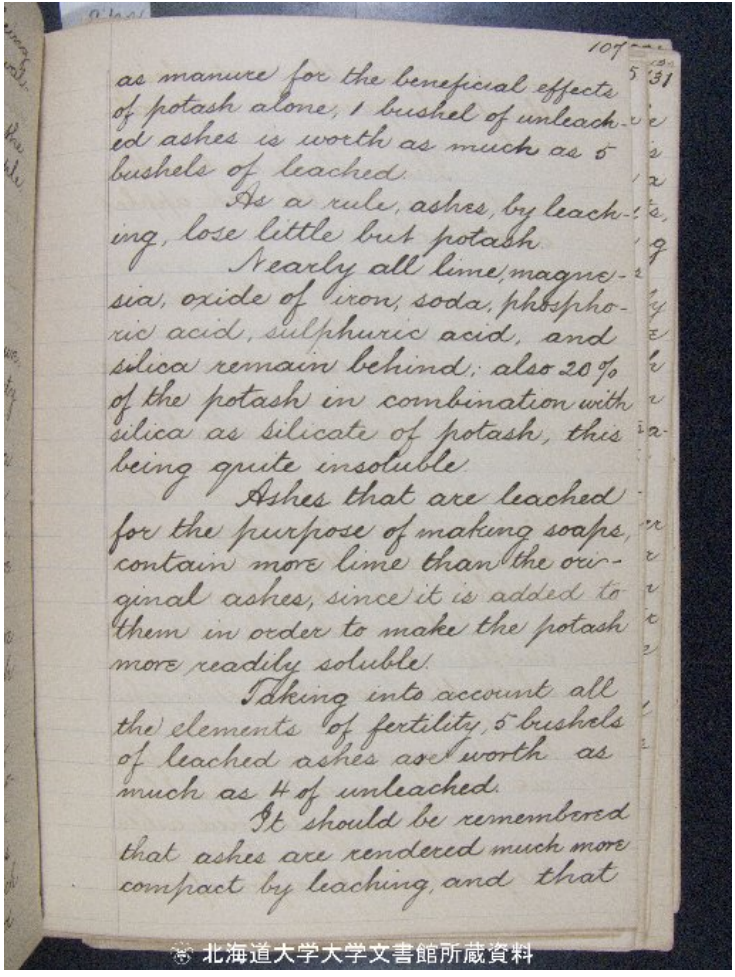
Solubility of Ashes.

To be effective as manure, ashes must possess the property of being soluble in water.

In hard wood-ashes, a somewhat smaller percent is soluble than in the ashes of soft wood, and therefore, the latter act more quickly than the former.

On most soils, ashes are chiefly valuable for the potash which they contain, although the other elements, such as lime, magnesia, and phosphoric acid, are also valuable.

By being leached, ashes lose about 4/5 of the potash which they contain; therefore, if used



as manure for the beneficial effects of potash alone, 1 bushel of unleached ashes is worth as much as 5 bushels of leached.

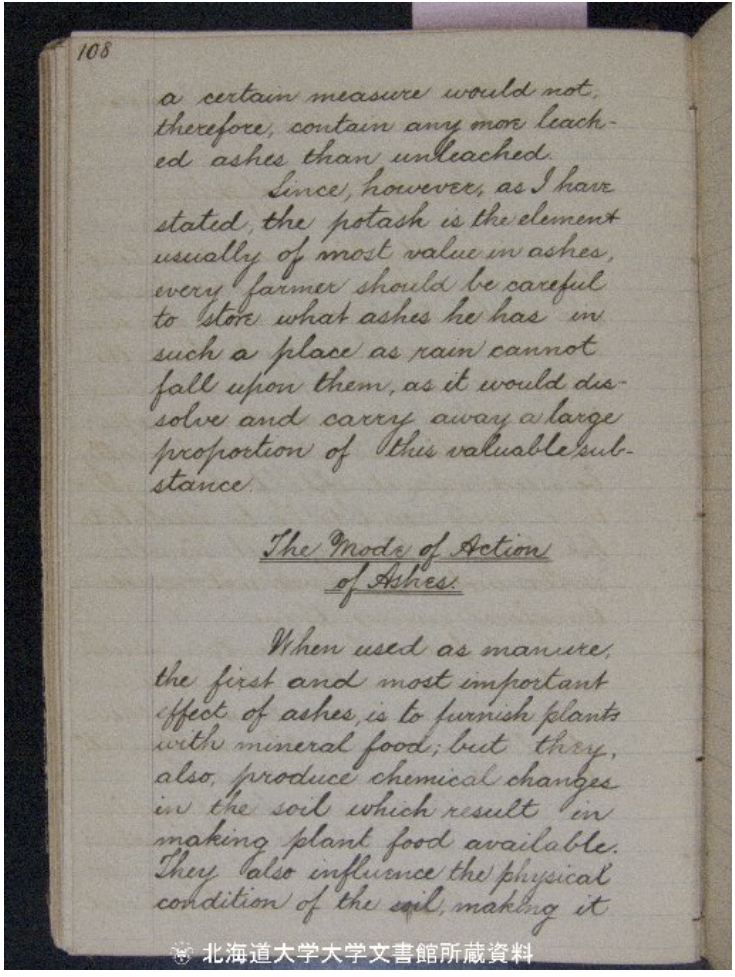
As a rule, ashes, by leaching, lose little but potash.

Nearly all lime, magnesia, oxide of iron, soda, phosphoric acid, sulphuric acid, and silica remain behind; also 20% of the potash in combination with silica as silicate of potash, this being quite insoluble.

Ashes that are leached forthe purpose of making soaps, contain more lime than the original ashes, since it is added to them in order to make the potash more readily soluble.

Taking into account all the elements of fertility, 5 bushels of leached ashes are worth as much as 4 of unleached.

It should be remembered that ashes are rendered much more compact by leaching, and that

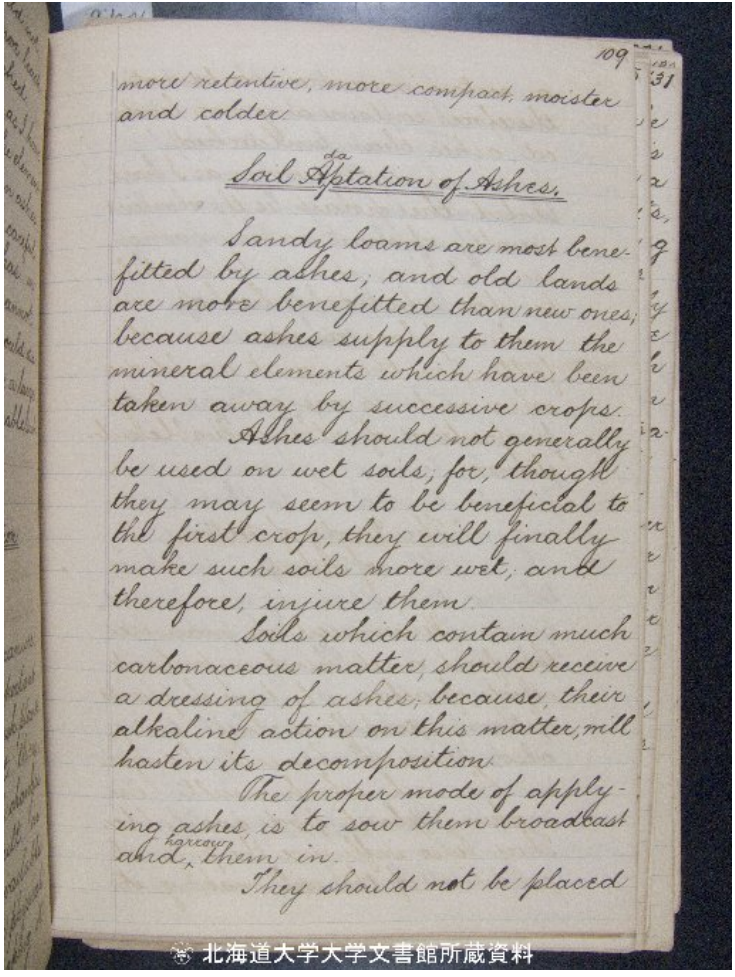


a certain measure would not, therefore, contain any more leached ashes than unleached.

Since, however, as I have stated, the potash is the element usually of most value in ashes, every farmer should be careful to store what ashes he has in such a place as rain cannot fall upon them, as it would dissolve and carry away a large proportion of this valuable substance.

Theo Mode of Action of Ashes.

When used as manure, the first and most important effect of ashes, is to furnish plants with mineral food; but they, also, produce chemical changes in the soil which result in making plant food available. They also influence the physical condition of the soil, making it



more retentive, more compact, moister and colder.

Soil Adaptation of Ashes.

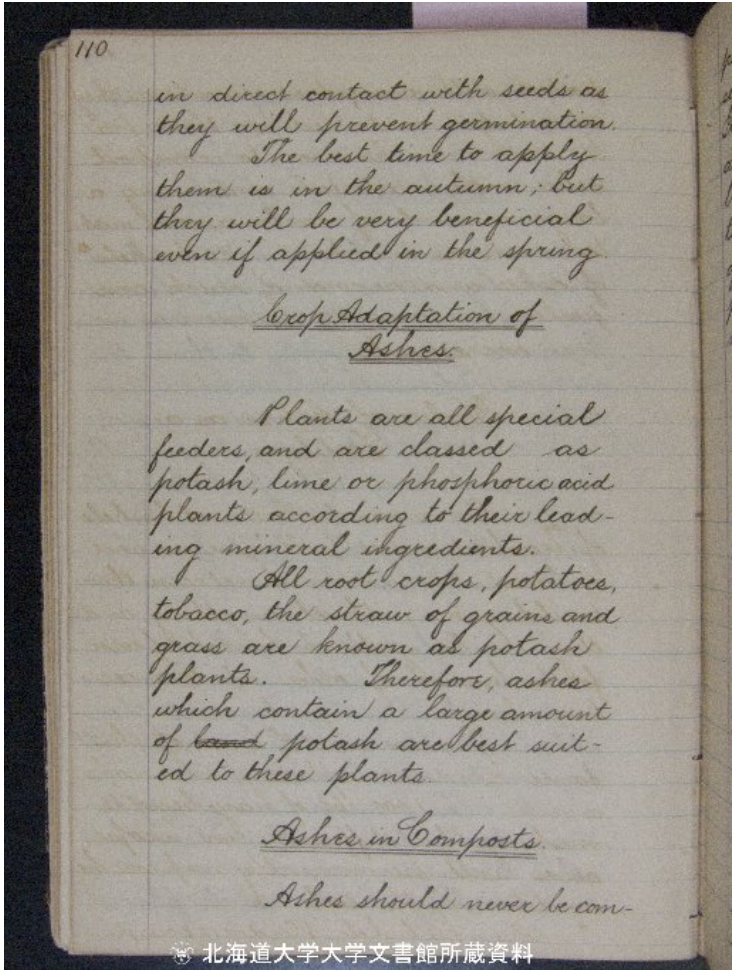
Sandy loams are most benefitted by ashes; and old lands are more benefitted than new ones; because ashes supply to them the mineral elements which have been taken away by successive crops.

Ashes should not generally be used on wet soils; for, though they may seem to be beneficial to the first crop, they will finally make such soils more wet; and therefore, injure them.

Soils which contain much carbonaceous matter, should receive a dressing of ashes; because, their alkaline action on this matter, will hasten its decomposition.

The proper mode of applying ashes, is to sow them broadcast and harrow them in.

They should not be placed



in direct contact with seeds as they will prevent germination.

The best time to apply them is in the autumn; but they will be very beneficial even if appliedin the spring.

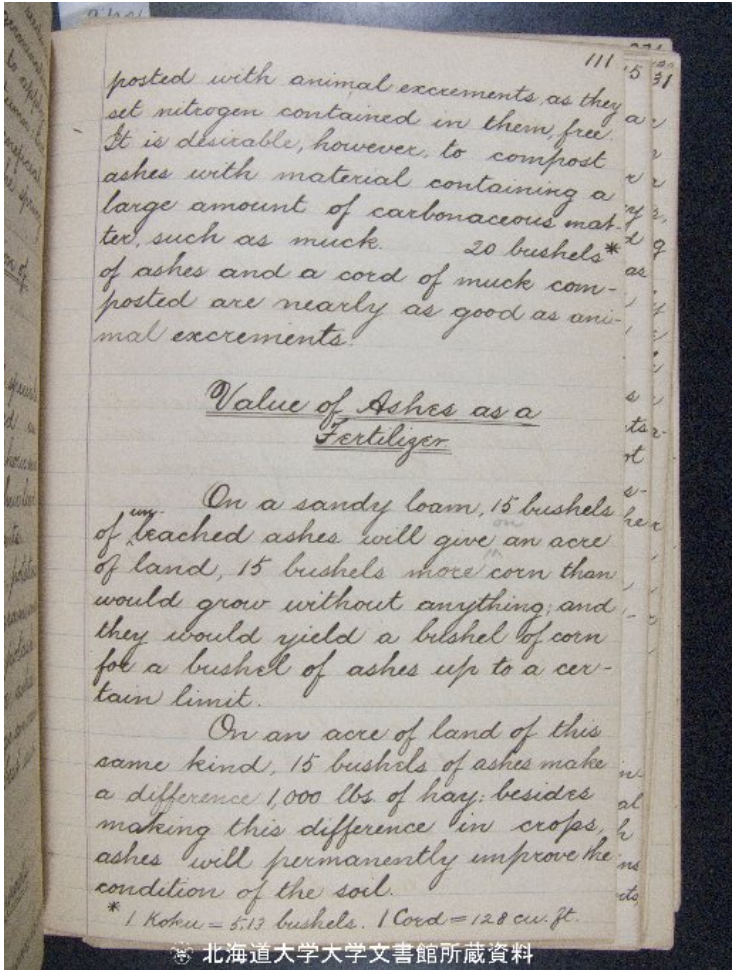
Crop Adaptation of ashes.

Plants are all special feeders, and are classed as potash, lime or phosphoric acid plants according to their leading mineral ingredients.

All root crops, potatoes, tobacco, the straw of grains and grass are known as potash plants. Therefore, ashes which contain a large amount of potash are best suited to these plants.

Ashes in Composts.

Ashes should never be composted



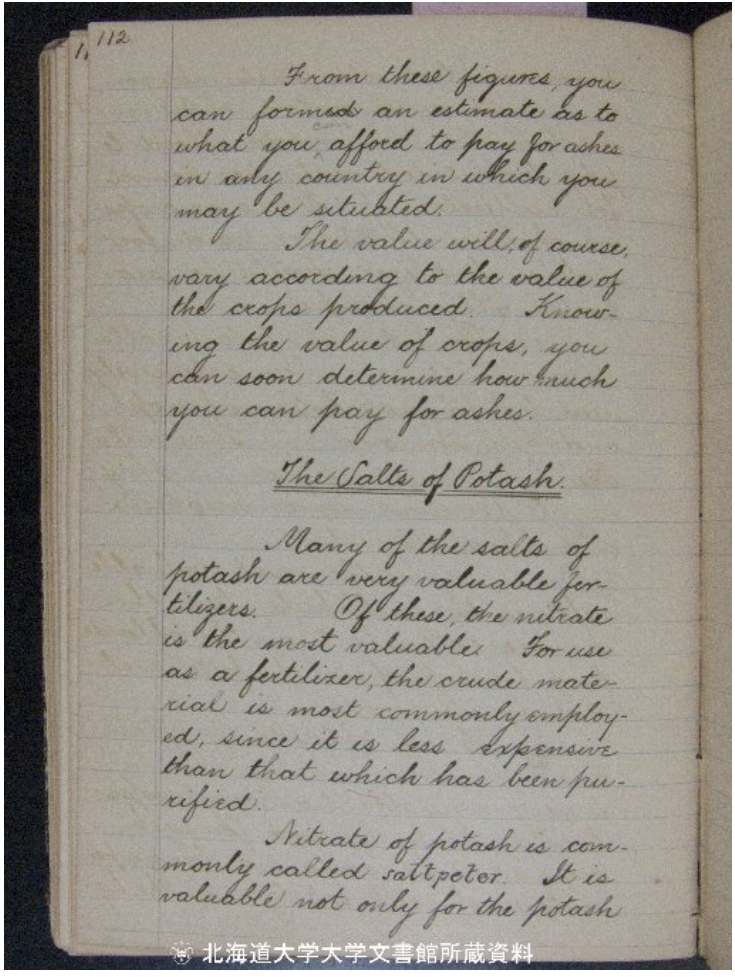
with animal excrements, as they set nitrogen contained in them, free. It is desirable, however, to compost ashes with material containing a large amount of carbonaceous matter, such as much 20 bushels * of ashes and a cord of muck composted are nearly as good as animal excrements.

Value of Ashes as a Fertilizer.

On a sandy loam, 15 bushels of un-beached ashes will give on an acre of land, 15 bushels more corn than would grow without anything; and they would yield a bushel of corn for a bushel of ashes up to a certain limit.

On an acre of land of this same kind, 15 bushels of ashes make a difference 1,000 lbs. of hay: besides making this difference in crops ashes will permanently improve the condition of the soil.

* 1 Koku = 5.13 bushels. 1 Cord = 128 cu. ft.



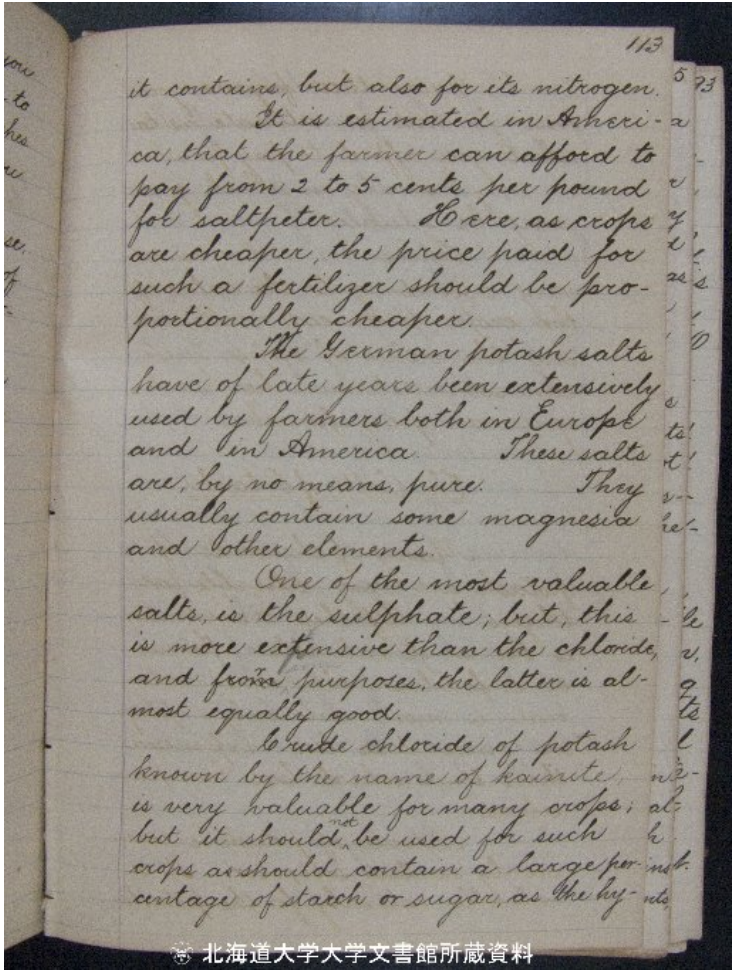
From these figures, you can form an estimate as to what you can afford to pay for ashes in any country in which you may be situated.

The value will, of course, vary according to the value of the crops produced. Knowing the value of crops. you can soon determine how much you can pay for ashes.

The Salts of Potash.

Many of the salts of potash are very valuable fertilizers. Of these, the nitrate is the most valuable. For use as a fertilizer, the crude material is most commonly employed, since it is less expensive than that which has been purified.

Nitrate of potash is commonly called saltpeter. It is valuable not only for the potash



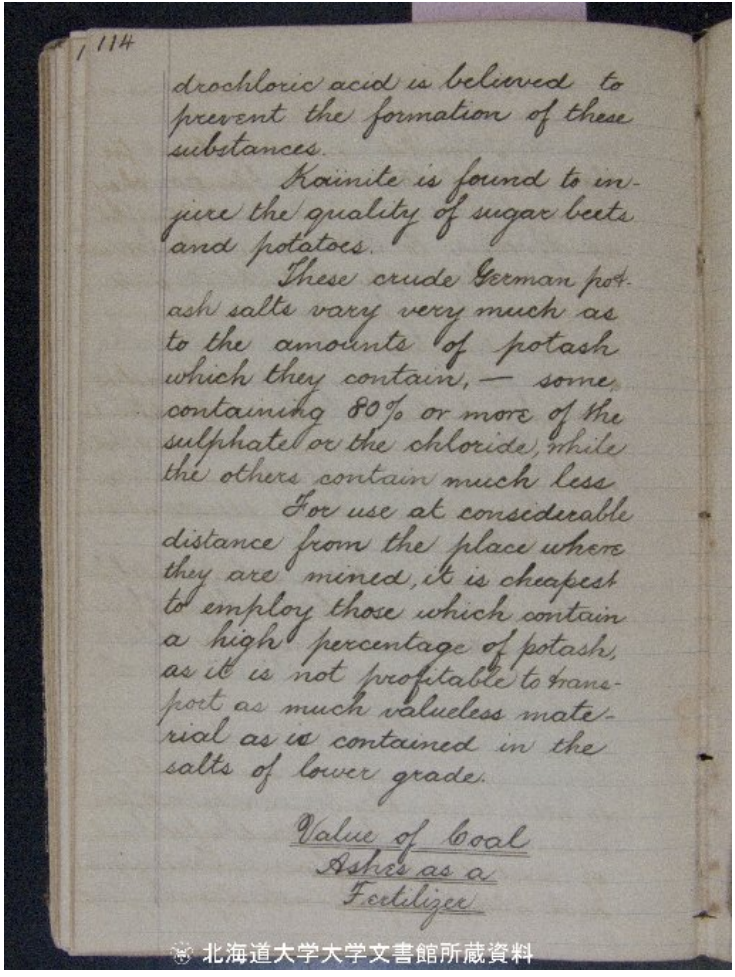
it contains, but also for its nitrogen.

It is estimated in America, that the farmer can afford to pay from 2 to 5 cents per pound for saltpeter. Here, as crops are cheaper, the price paid for such a fertilizer should be proportionally cheaper.

The German potash salts have of late years been extensively used by farmers both in Europe and in America. These salts are, by no means, pure. They usually contain some magnesia and other elements.

One of the most valuable salts, is the sulphate; but, this is more extensive than the chloride, and for purposes, the latter is almost equally good.

Crude chloride of potash known by the name of kainite, is very valuable for many crops; but it should not used for such crops as should contain a large percentage of starch or sugar, as the hydrochloric



drochloric acid is believed to prevent the formation of these substances.

Kainite is found to injure the quality of sugar beets and potatoes.

These crude German potash salts vary very much as to the amounts of potash which they contain, — some containing 80% or more of the sulphate or the chloride, while the others contain much less

For use at considerable distance from the place where they are mined, it is cheapest to employ those which contain a high percentage of potash, as it is not profitable to transport as much valueless material as is contained in the salts of lower grade.

Value of Coal Ashes as a Fertilizer

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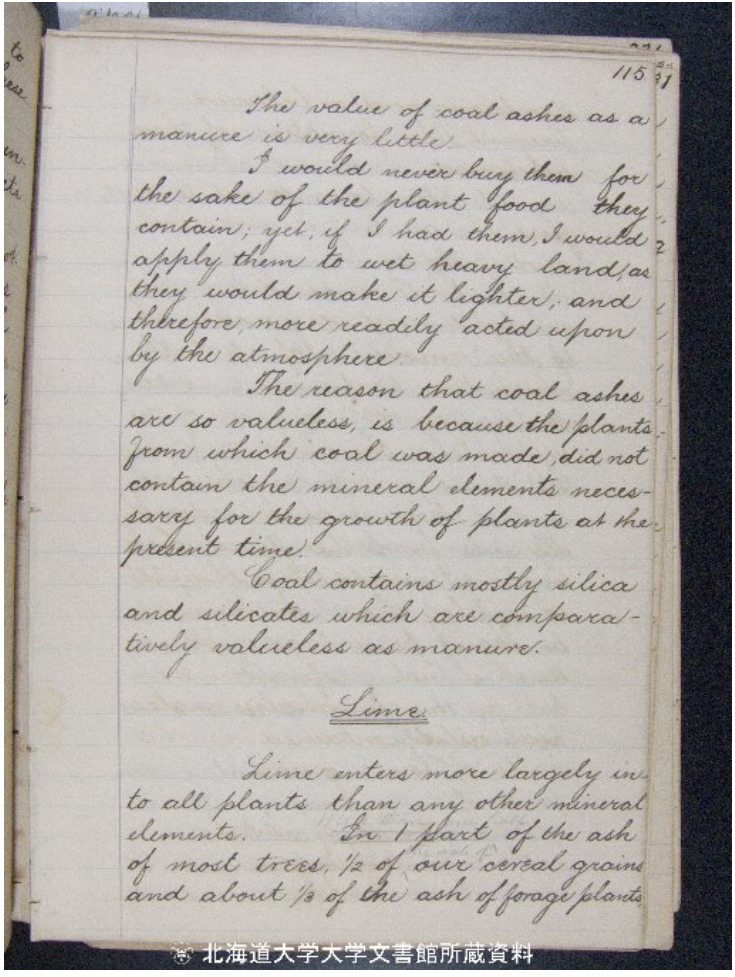


The value of coal ashes as a manure is very little.

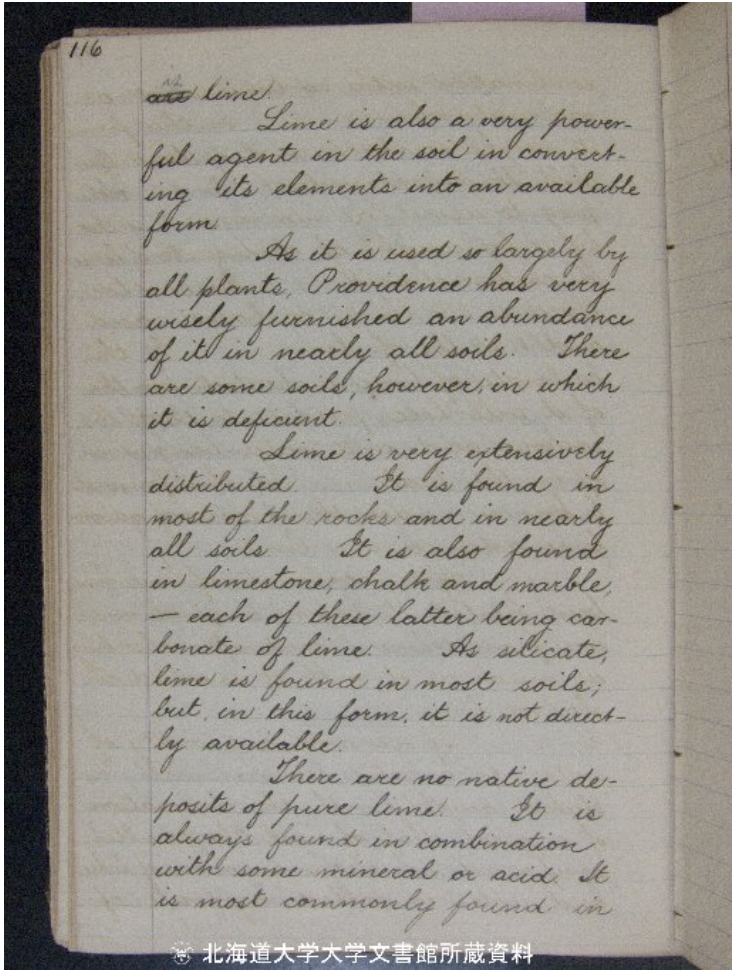
I would never buy them for the sake of the plant food they contain, yet, if I had them, I would apply them to wet heavy land, as they would make it lighter; and therefore, more readily acted upon by the atmosphere.

The reason that coal ashes are so valueless, is because the plants from which coal was made, did not contain the mineral elements necessary for the growth of plants at he present time.

Coal contains mostly silica and silicates which are comparatively valueless as manure.

Lime.

Lime enters more largely into all plants than any other mineral elements. In 1 part of the ash of most tress, 1/2 of our cereal grains and about 1/3 of the ash of forage plants



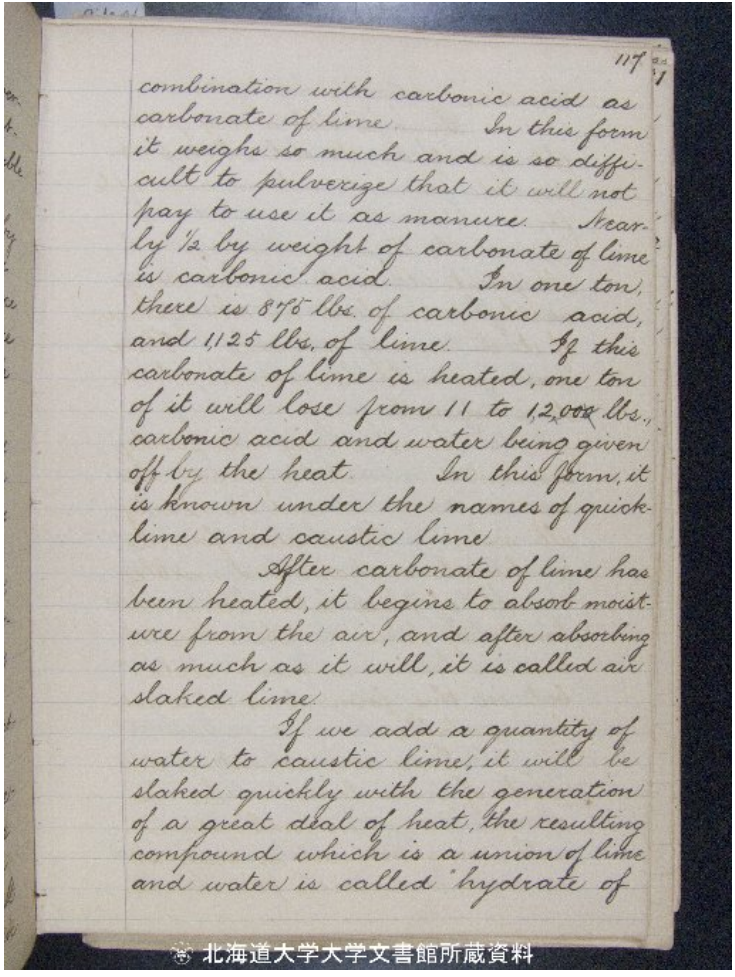
is lime.

Lime is also a very powerful agent in the soil in converting its elements into an available form.

As it is used so largely by all plants, Providence has very wisely furnished an abundance of it in nearly all soils. There are some soils, However, in which it is deficient.

Lime is very extensively distributed. It is found in most of the rocks and in nearly all soils. It is also found in limestone, chalk and marble, —— each of these latter being carbonate of lime. As silicate, lime is found in most soils; but, in this form, it is not directly available.

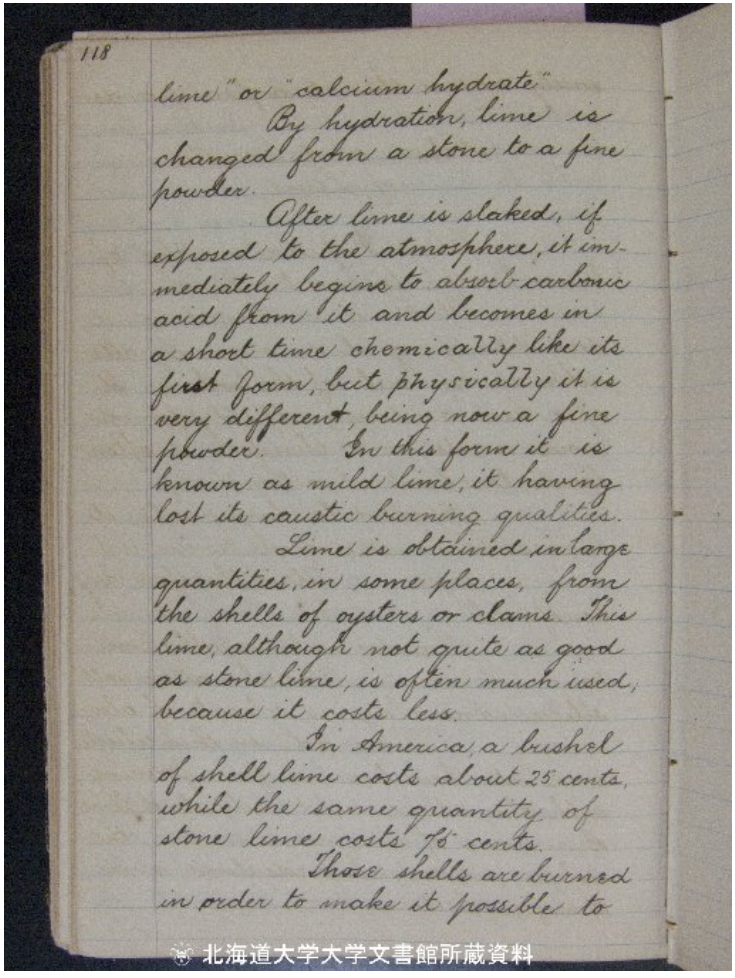
There are no native deposits of pure lime. It is always found in combination with some mineral or acid. It is most commonly found in



combination with carbonic acid as carbonate of lime. In this form it weighs so much and is so difficult to pulverize that it will not pay to use it as manure. Nearly 1/2 by weight of carbonate of lime is carbonic acid. In one ton, there is 875 lbs. of carbonic acid, and 1,125 lbs. of lime. If this carbonate of lime is heated, one ton of it will lose from 11 to 1,200 lbs., carbonic acid and water being given off by the heat. In this form, it is known under the names of quicklime and caustic lime.

After carbonate of lime has been heated, it begins to absorb moisture from the air, and after absorbing as much as it will, it is called air slaked lime.

If we add a quantity of water to caustic lime, it will be slaked quickly with the generation of a great deal of heat, the resulting compound which is a union of lime and water is called “hydrate of



lime" or "calcium hydrate".

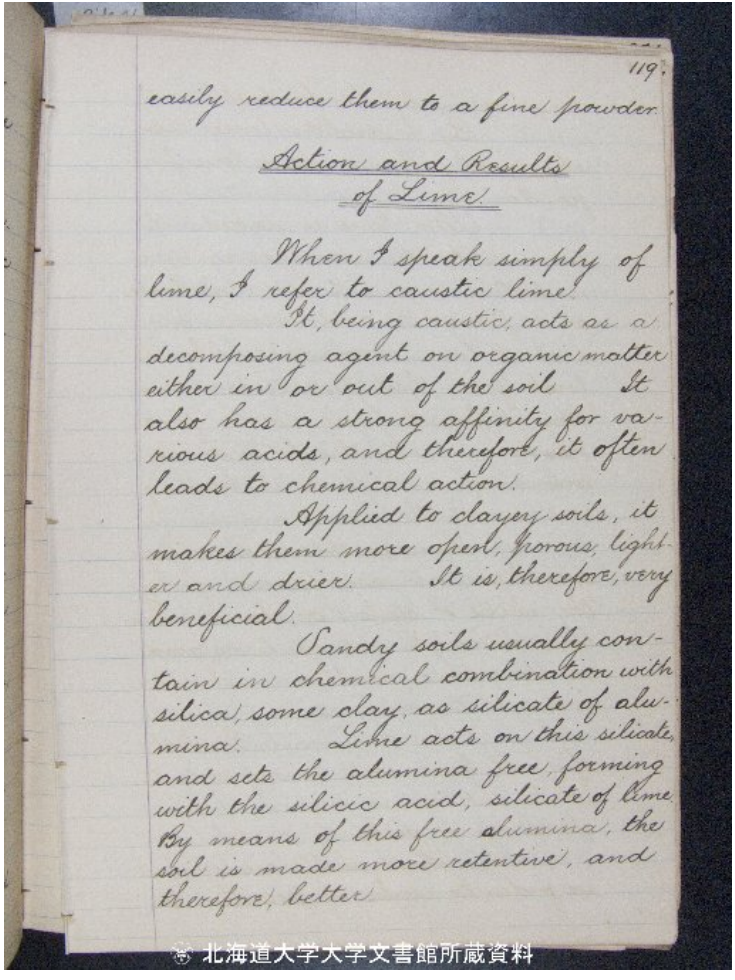
By hydration, lime is changed from a stone to a fine powder.

After lime is slaked, if exposed to the atmosphere, it immediately begins to absorb carbonic acid from it and becomes in a short time chemically like its first form, but physically it is very different, being now a fine powder. In this form it is known as mild lime, it having lost its caustic burning qualities.

Lime is obtained in large quantities, in some places, from the shells of oysters or clams. This lime, although not quite as good as stone lime, is often much used, because it costs less.

In America a bushel of shell lime costs about 25 cents, while the same quantity of stone lime costs 75 cents.

Those shells are burned in order to



make it possible to easily reduce them to a fine powder.

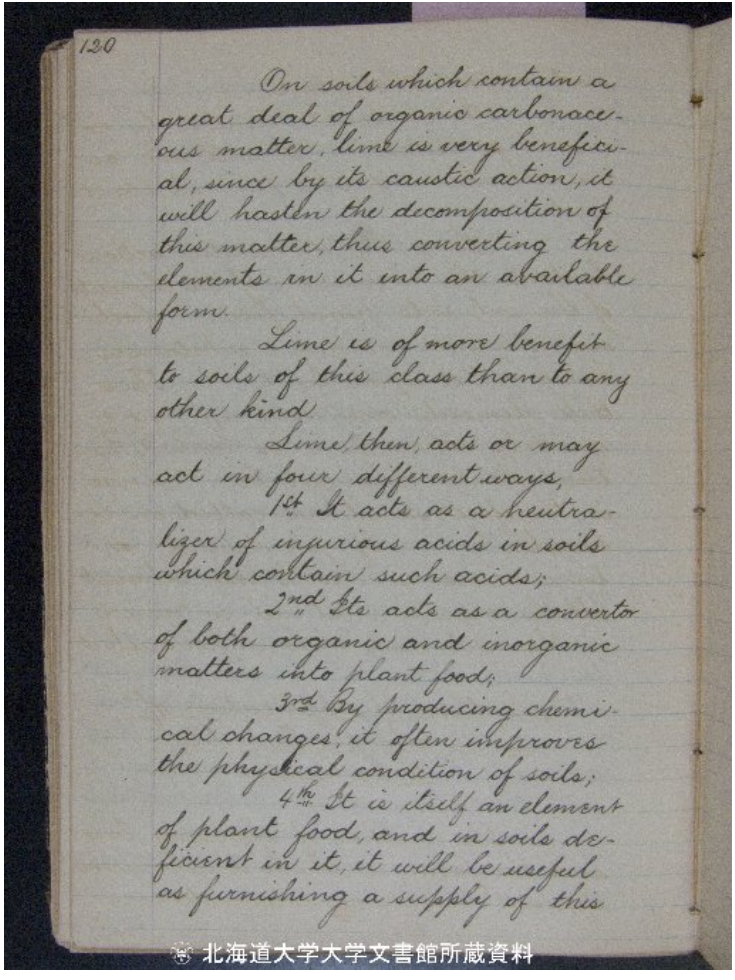
Action and Results of Lime.

When I speak simply of lime, I refer to caustic lime.

It, being caustic, acts as a decomposing agent on organic matter either in or out of the soil. It also has a strong affinity for various acids, and therefore, it often leads to chemical action.

Applied to clayey soils, it makes them more open, porous, lighter and drier. It is, therefore, very beneficial.

Sandy soils usually contain in chemical combination with silica, some clay, as silicate of alumina. Lime acts on this silicate, and sets the alumina free, forming with the silicic acid, silicate of lime. By means of this free alumina, the soil is made more retentive, and therefore, better.



On soils which contain a great deal of organic carbonaceous matter, lime is very beneficial, since by its caustic action, it will hasten the decomposition of this matter, thus converting the elements in it into an available form.

Lime is of more benefit to soils of this class than to any other kind.

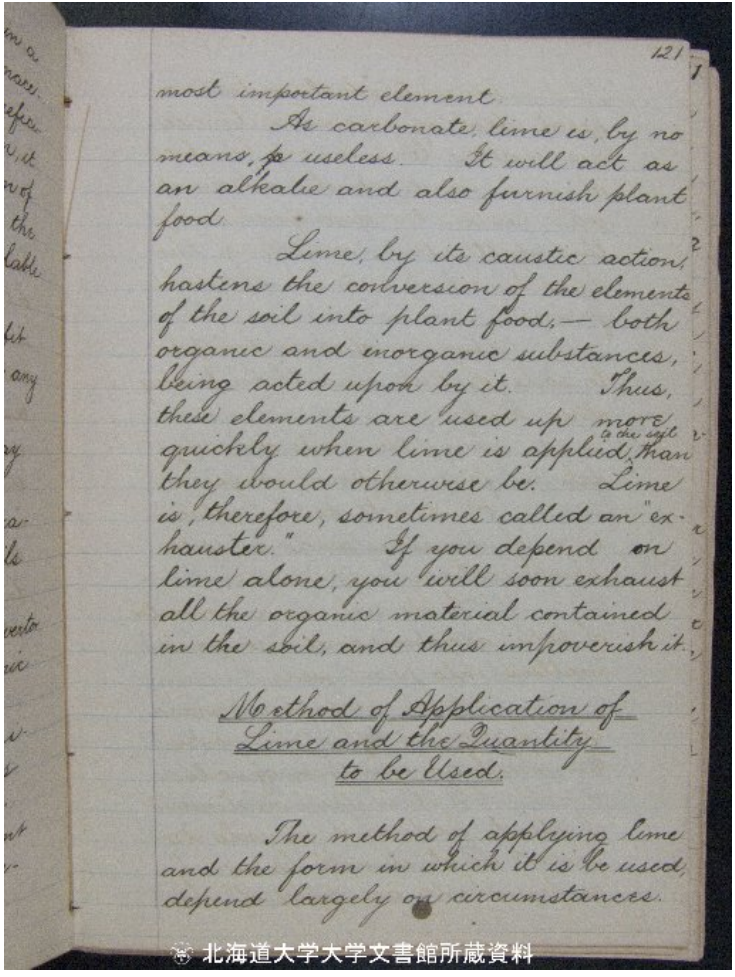
Lime, then, acts or may act in four different ways,

1st It acts as a neutralizer of injurious acids in soils which contain such acids;

2nd Its acts as a convertor of both organic and inorganic matters into plant food;

3rd By producing chemical changes, it often improves the physical condition of soils;

4th It is itself an element of plant food, and in soils deficient in it, it will be useful as furnishing a supply of this



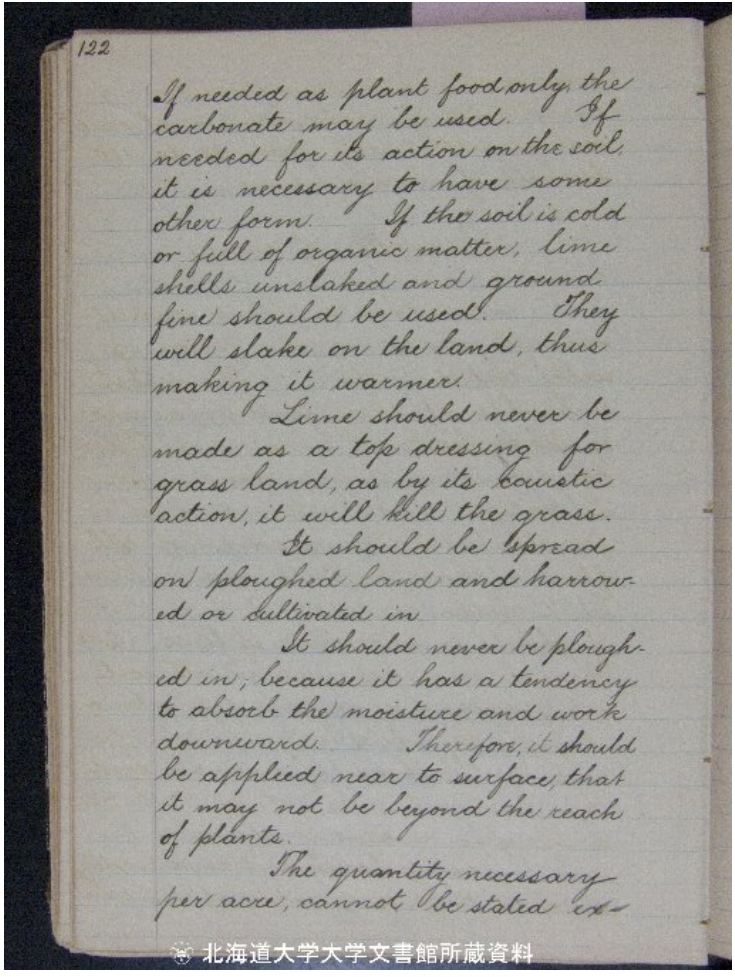
most important element.

As carbonate, lime is, by no means, useless. It will act as an alkalie and also furnish plant food.

Lime, by its caustic action, hastens the conversion of the elements of the soil into plant food, —— both organic and inorganic substances, being acted upon by it. Thus, these elements are used up more quickly when lime is applied to the soil man they would otherwise be. Lime is, therefore, sometimes called an “exhauster”. If you depend on lime alone, you will soon exhaust all the organic material contained in the soil, and thus impoverish it.

Method of Application of
Lime and the Quantity
to be Used.

The method of applying lime and the form in which it is be used, depend largely on circumstances.



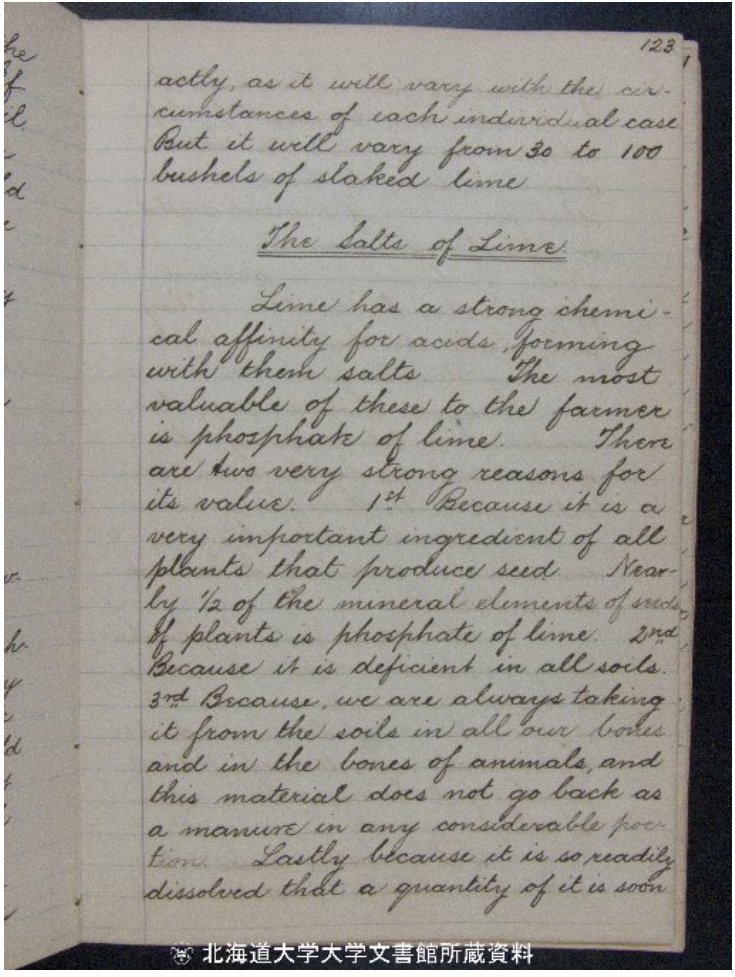
If needed as plant food only, the carbonate may be used. If needed for its action on the soil, it is necessary to have some other form. If the soil is cold or full of organic matter, lime shells unslaked and ground fine should be used. They will slake on the land, thus making it warmer.

Lime should never be made as a top dressing for grass land, as by its caustic action, it will kill the grass.

It should be spread on ploughed land and harrowed or cultivated in.

It should never be ploughed in; because it has a tendency to absorb the moisture and work downward. Therefore, it should be applied near to surface, that it may not be beyond the reach of plants.

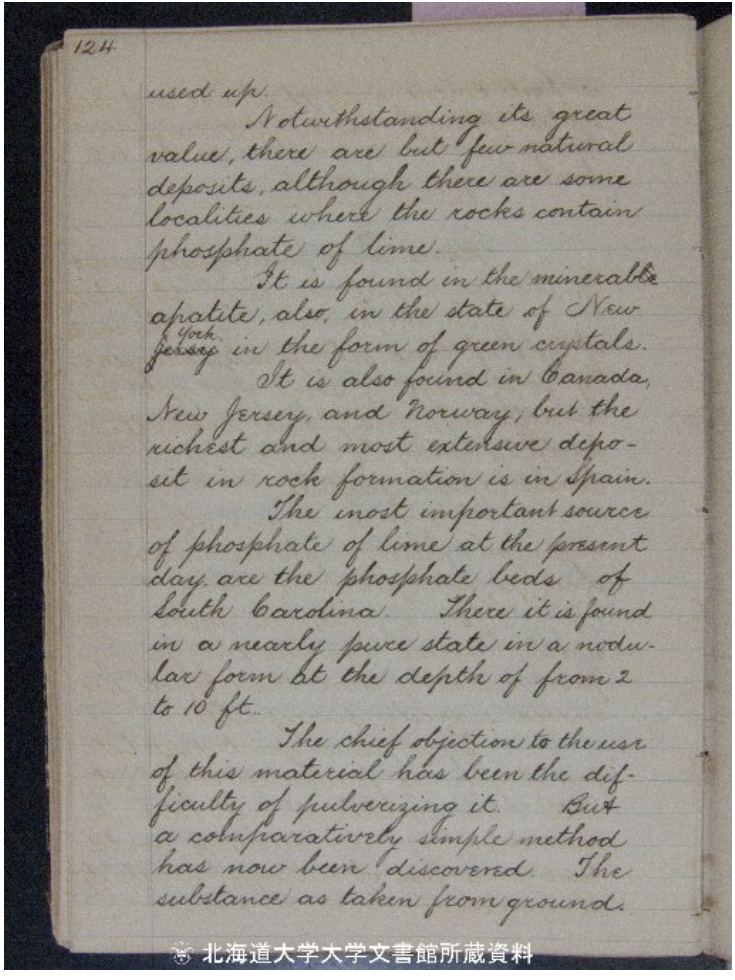
The quantity necessary per acre, cannot be stated exactly,



as it will vary with the circumstances of each individual case. But it will vary from 30 to 100 bushels of slaked lime.

The Salts of Lime.

Lime has a strong chemical affinity for acids, forming with them salts. The most valuable of these to the farmer is phosphate of lime. There are two very strong reasons for its value. 1st Because it is a very important ingredient of all plants that produce seed. Nearly, 1/2 of the mineral elements of seeds. If plants is phosphate of lime. 2nd Because it is deficient in all soils. 3rd Because, we are always taking it from the soils in all our bones and in the bones of animals, and this material does not go back as a manure in any considerable portion. Lastly because it is so readily dissolved that a quantity of it is soon



used up.

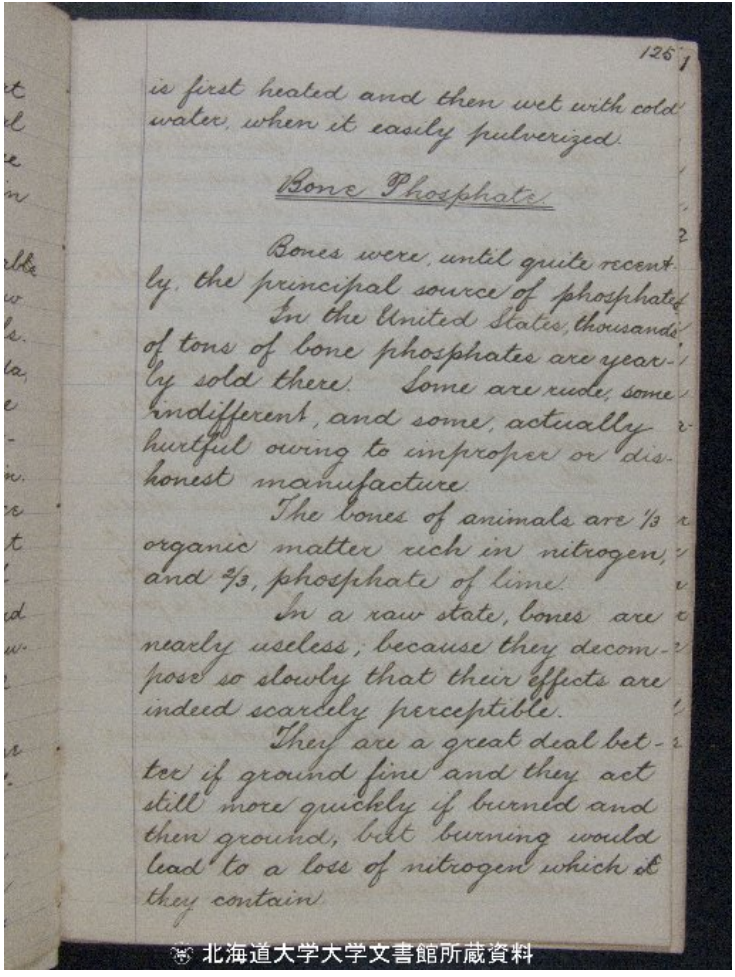
Notwithstanding its great value, there are but few natural deposits, although there are some localities where the rocks contain phosphate of lime.

It is found in the mineral apatite; also, in the state of New York in the form of green crystals.

It is also found in Canada, New Jersey, and Norway, but the richest and most extensive deposit in rock formation is in Spain.

The most important source of phosphate of lime at the present day, are the phosphate beds of South Carolina. There it is found in a nearly pure state in a nodular form at the depth of from 2 to 10 ft..

The chief objection to the use of this material has been the difficulty of pulverizing it. But a comparatively simple method has now been discovered. The substance as taken from ground,



is first heated and then wet with coldwater, when it easily pulverized.

Bone Phosphate.

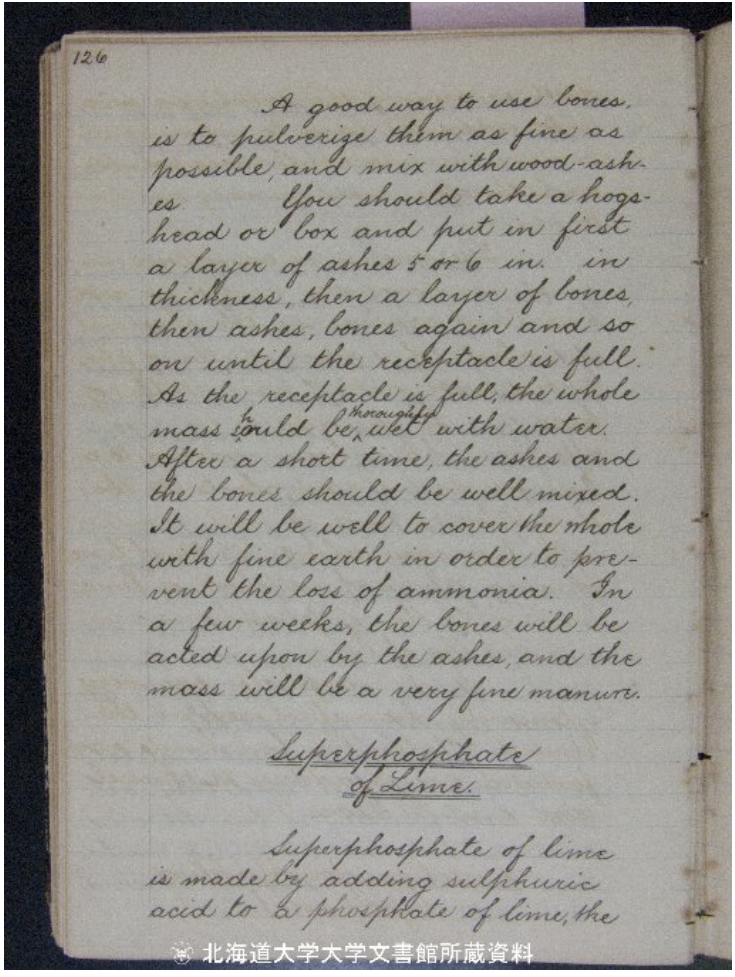
Bones were, until quite recently, the principal source of phosphates.

In the United States, thousands of tons of bone phosphates are yearly sold there. Some are rude, some indifferent, and some, actually hurtful owing to improper or dishonest manufacture.

The bones of animals are 1/3 organic matter rich in nitrogen, and 2/3, phosphate of lime.

In a raw state, bones are nearly useless; because they decompose so slowly that their effects are indeed scarcely perceptible.

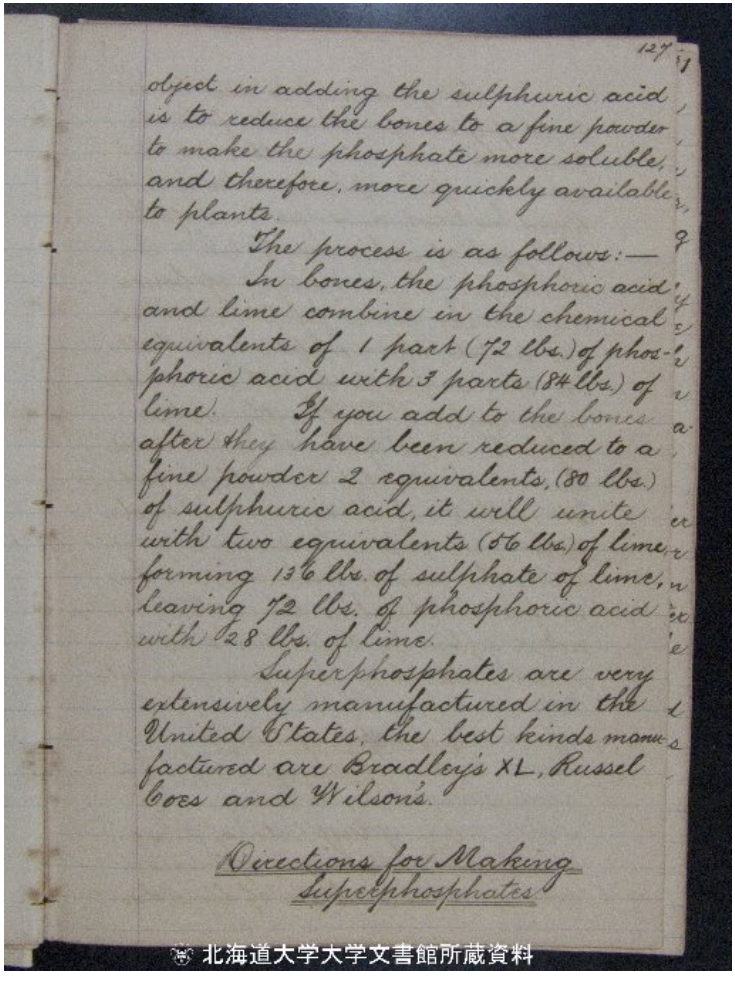
They are a great deal better if ground fine and they act still more quickly of burned and then ground, but burning would lead to a loss of nitrogen which they contain.



A good way to use bones, is to pulverize them as fine as possible, and mix with wood-ashes. You should take a hogshead or box and put in first a layer of ashes 5 or 6 in. in thickness, then a layer of bones, then ashes, bones again and so on until the receptacle is full. As the receptacle is full, the whole mass should be thoroughly wet with water. After a short time, the ashes and the bones should be well mixed. It will be well to cover the whole with fine earth in order to prevent the loss of ammonia. In a few weeks, the bones will be acted upon by the ashes, and the mass will be a very fine manure.

Superphosphate
of Lime

Superphosphate of lime is made by adding sulphuric acid to a phosphate of lime, the



object in adding the sulphuric acid is to reduce the bones to a fine powder to make the phosphate more soluble, and therefore, more quickly available to plants.

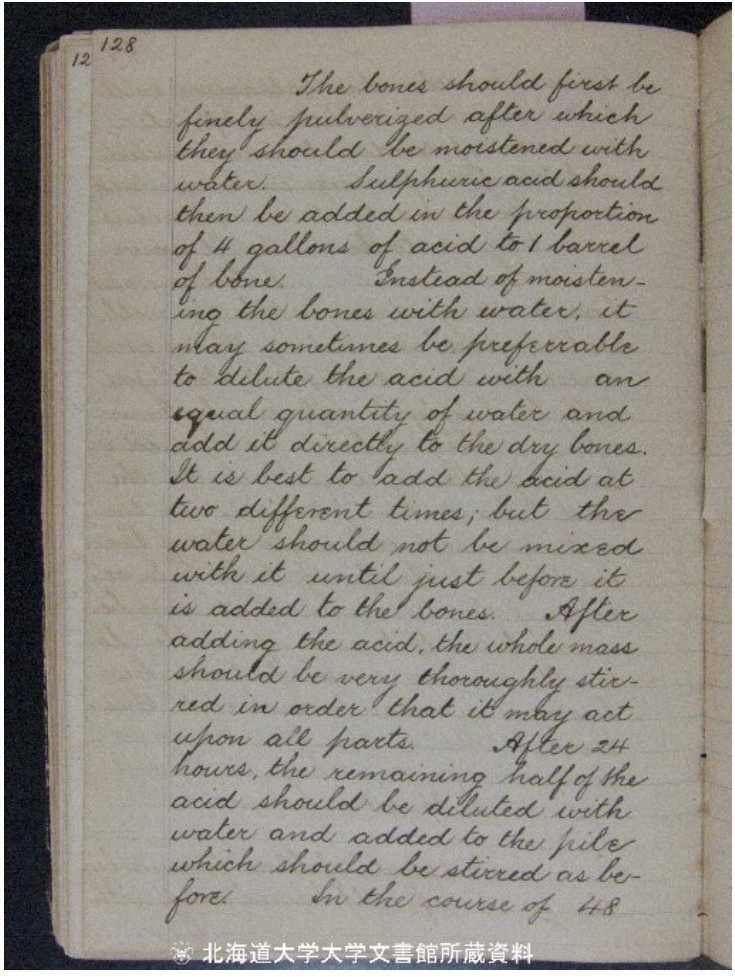
The process is as follows: ——

In bones, the phosphoric acid and lime combine in the chemical equivalents of 1 part (72 lbs.) of phosphoric acid with 3 parts (84 lbs.) of lime. If you add to the bones after they have been reduced to a fine powder 2 equivalents, (80 lbs.) of sulphuric acid, it will unite with two equivalents (56 lbs.) of lime, forming 136 lbs. of sulphate of lime, leaving 72 lbs. of phosphoric acid with 28 lbs. of lime.

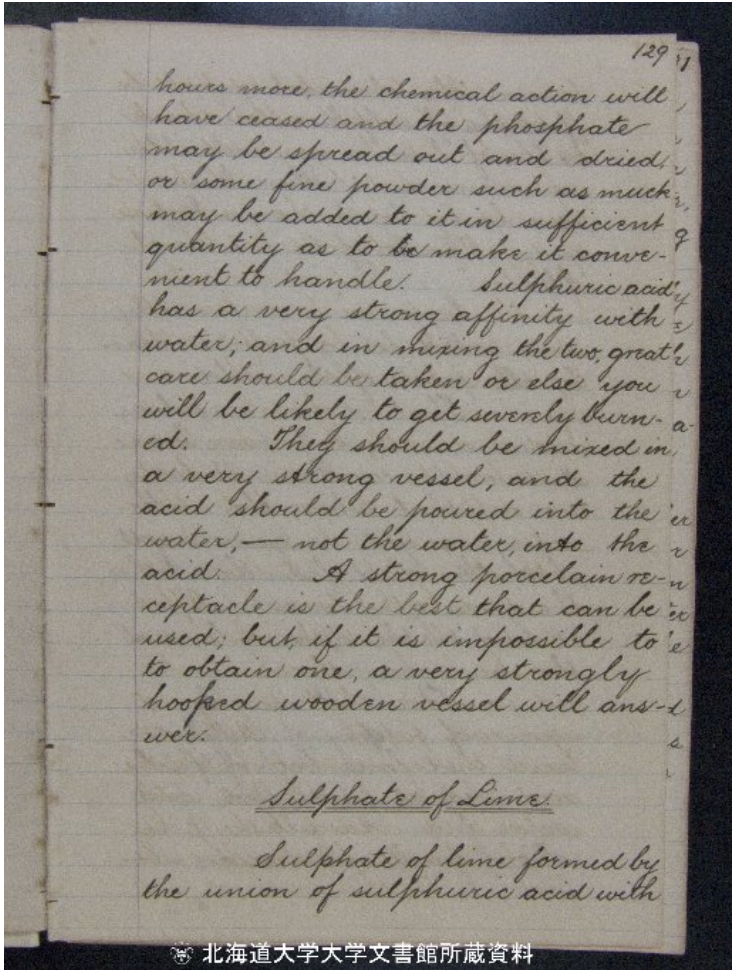
Superphosphates are very extensively manufactured in the United States, the best kinds manufactured are Bradley's XL, Russel Coes and Wilson's.

Directions for Making

Superphosphates.



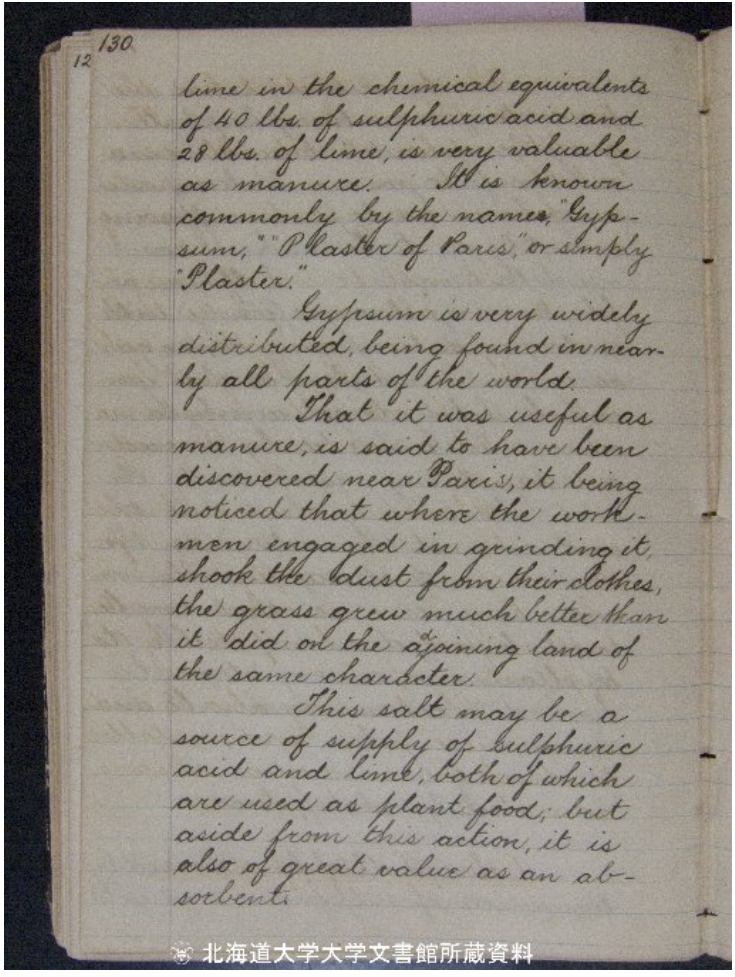
The bones should first be finely pulverized after which they should be moistened with water. Sulphuric acid should then be added in the proportion of 4 gallons of acid to 1 barrel of bone. Instead of moistening the bones with water, it may sometimes be preferrable to dilute the acid with an equal quantity of water and add it directly to the dry bones. It is best to add the acid at two different times; but the water should not be mixed with it until just before it is added to the bones. After adding the acid, the whole mass should be very thoroughly stirred in order that it may act upon all parts. After 24 hours, the remaining half of the acid should be diluted with water and added to the pile which should be stirred as before. In the course of 48



hours more, the chemical action will have ceased and the phosphate may be spread out and dried, or some fine powder such as muck may be added to it in sufficient quantity as to make it convenient to handle. Sulphuric acid has a very strong affinity with water; and in mixing the two, great care should be taken or else you will be likely to get severely burned. They should be mixed in a very strong vessel, and the acid should be poured into the water, —— not the water, into the acid. A strong porcelain receptacle is the best that can be used; but, if it is impossible to to obtain one, a very strongly hooped wooden vessel will answer.

Sulphate of Lime.

Sulphate of lime formed by the union of sulphuric acid with

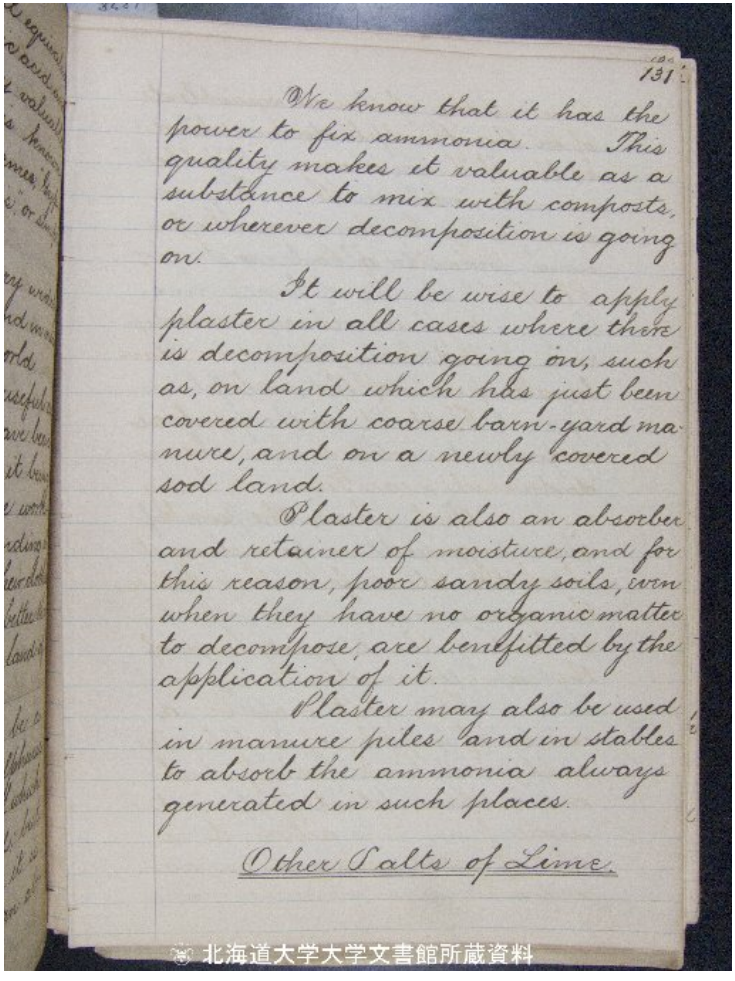


lime in the chemical equivalents of 40 lbs. of sulphuric acid and 28 lbs. of lime, is very valuable as manure. It is known commonly by the nam, “Gypsum”, “Plaster of Paris”, or simply “Plaster”.

Gypsum is very widely distributed, being found in nearly all parts of the world.

That it was useful as manure, is said to have been discovered near Paris, it being noticed that where the workmen engaged in grinding it, shook the dust from their clothes, the grass grew much better than it did on the adjoining land of the same character.

This salt may be a source of supply of sulphuric acid and lime, both of which are used as plant food; but aside from this action, it is also of great value as an absorbent.



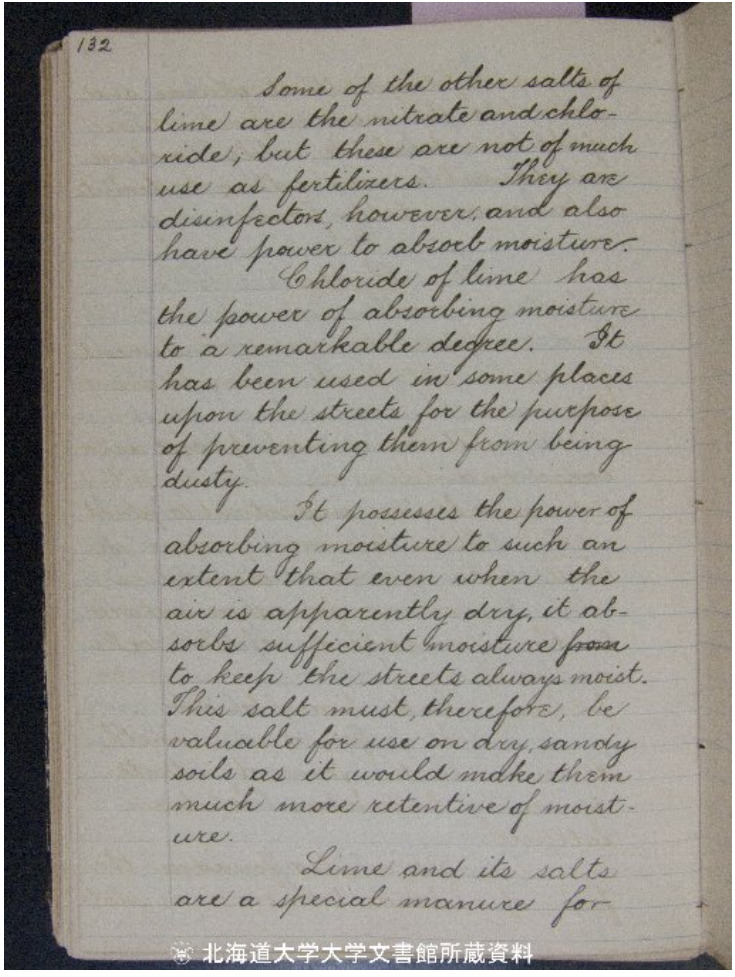
We know that it has the power to fix ammonia. This quality makes it valuable as a substance to mix with composts, or wherever decomposition is going on.

It will be wise to apply plaster in all cases where there is decomposition going on, such as, on land which has just been covered with coarse barn-yard manure, and on a newly covered sod land.

Plaster is also an absorber and retainer of moisture, and for this reason, poor sandy soils, even when they have no organic matter to decompose, are benefitted by the application of it.

Plaster may also be used in manure piles and in stables to absorb the ammonia always generated in such places.

Other Salts of Lime.

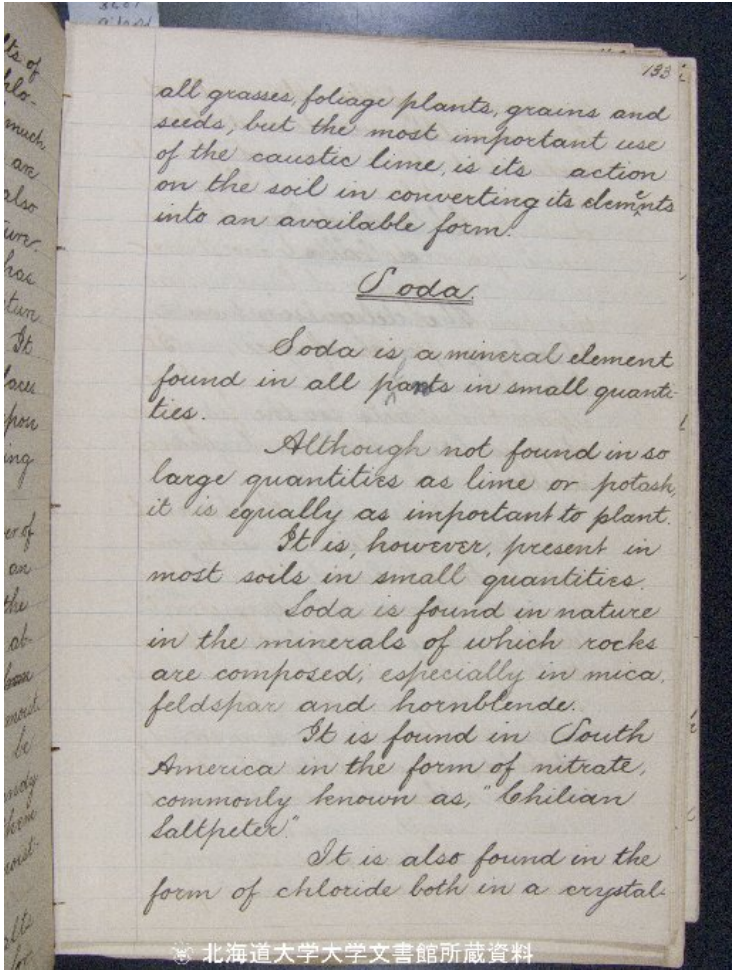


Some of the other salts of lime are the nitrate and chloride; but these are not of much use as fertilizers. They are disinfectors, however, and also have power to absorb moisture.

Chloride of lime has the power of absorbing moisture to a remarkable degree. It has been used in some places upon the streets for the purpose of preventing them from being dusty.

It possesses the power of absorbing moisture to such an extent that even when the air is apparently dry, it absorbs sufficient moisture to keep the streets always moist. This salt must, therefore, be valuable for use on dry, sandy soils as it would make them much more retentive of moisture.

Lime and its salts are a special manure for



all grasses, foliage plants, grains and seeds, but the most important use of the caustic lime, is its action on the soil in converting its elements into an available form.

Soda.

Soda is a mineral element found in all plants in small quantities.

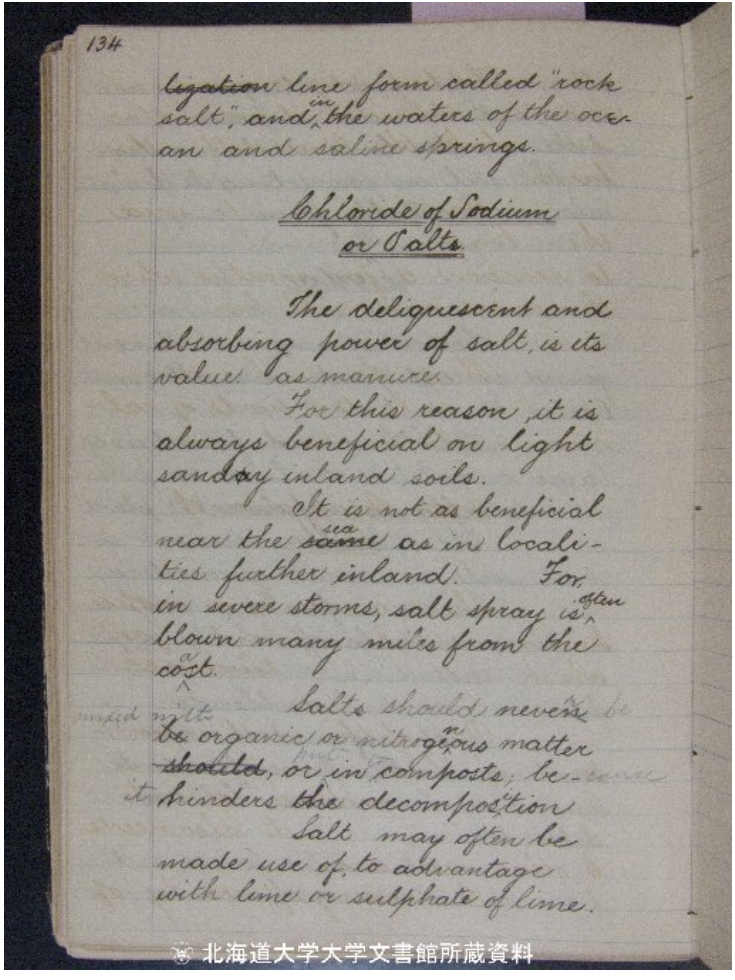
Although not found in so large quantities as lime or potash, it is equally as important to plant.

It is, however, present in most soils in small quantities.

Soda is found in nature in the minerals of which rocks are composed, especially in mica, feldspar and hornblende.

It is found in South America in the form of nitrate, commonly known as, “Chilian Saltpeter”.

It is also found in the form of chloride both in a crystal



line form called “rock salt”, and in the waters of the ocean and saline springs.

Chloride of Sodium

or Salt.

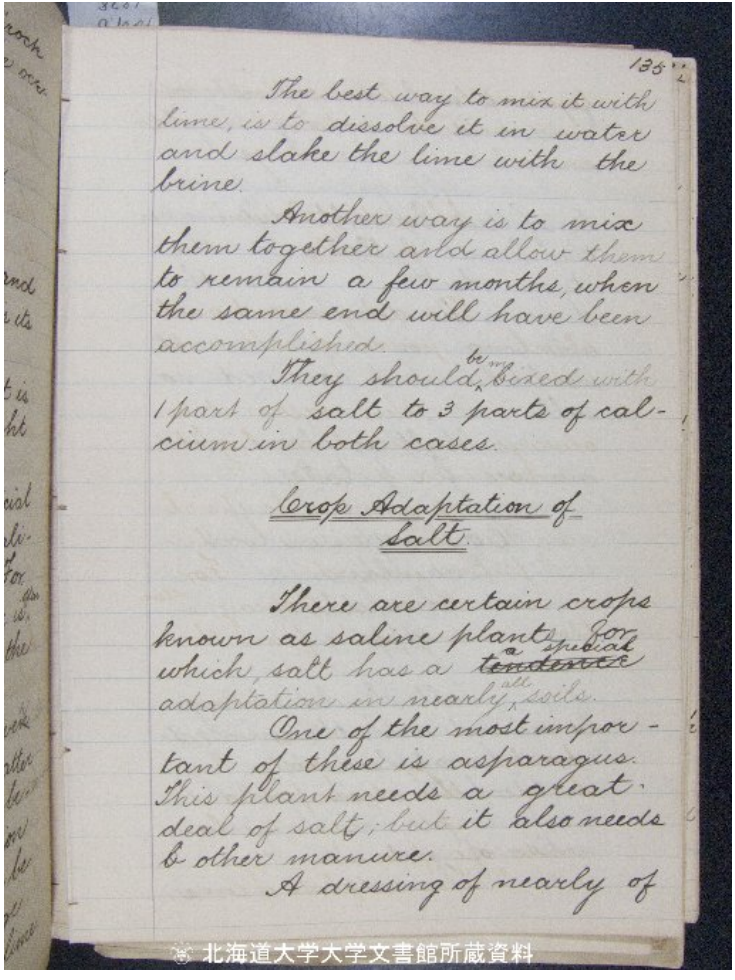
The deliquescent and absorbing power of salt, is its value as manure.

For this reason, it is always beneficial on light sandy inland soils.

It is not as beneficial near the sea as in localities further inland. For in severe storms, salt spray is often blown many miles from the coast.

Salt should never be mixed with organic or nitrogenous matter or put in to composts; be it hinders decomposition.

Salt may often be made use of, to advantage with lime or sulphate of lime.



The best way to mix it with lime, is to dissolve it in water and slake the lime with the brine.

Another way is to mix them together and allow them to remain a few months, when the same end will have been accomplished.

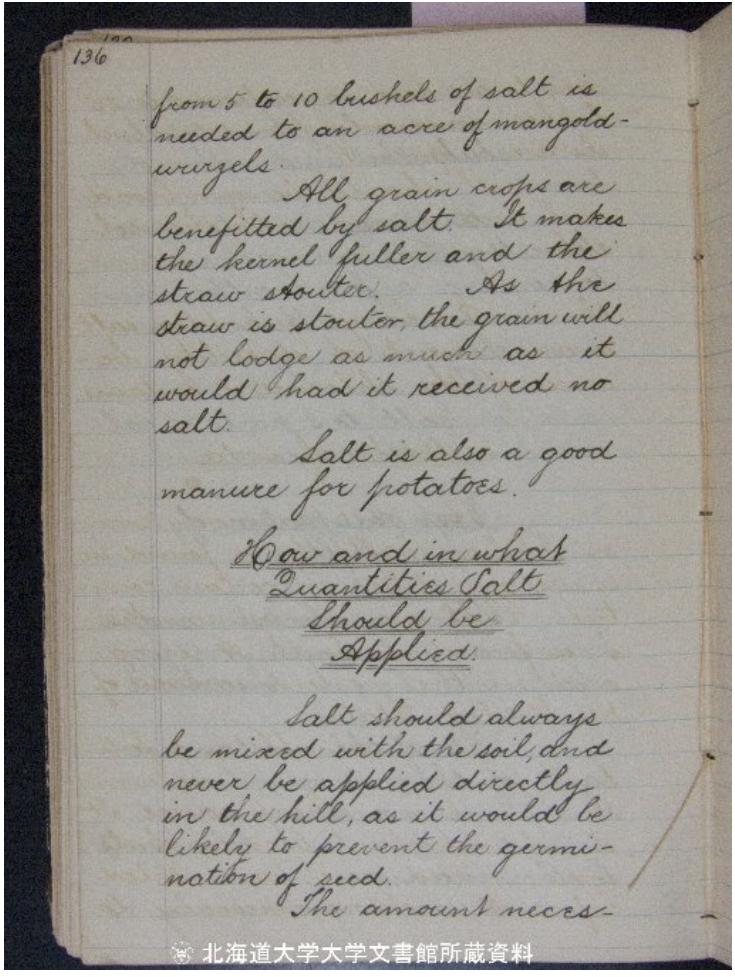
They should be mixed with 1 part of salt to 3 parts of calcium in both cases.

Crop Adaptation of Salt.

There are certain crops known as saline plants for which, salt has a special adaptation in nearly all soils.

One of the most important of these is asparagus. This plant needs a great deal of salt; but it also needs other manure.

A dressing of nearly of



from 5 to 10 bushels of salt is needed to an acre of mangold-wurzels.

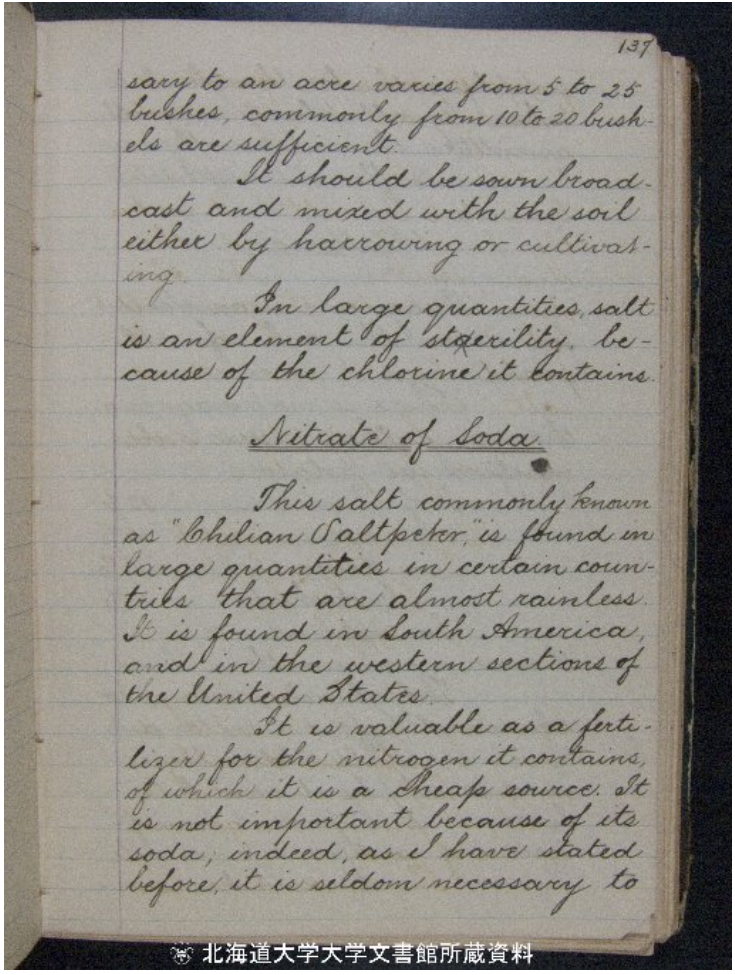
All grain crops are benefitted by salt. It makes the kernel fuller and the straw stouter. As the straw is stouter, the grain will not lodge as much as it would had it received no salt.

Salt is also a good manure for potatoes.

How and in what
Quantities Salt
Should be
Applied.

Salt should always be mixed with the soil, and never be applied directly in the hill, as it would be likely to prevent the germination of seed.

The amount necessary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sary to an acre varies from 5 to 25 bushes, commonly from 10 to 20 bushels are sufficient.

It should be sown broadcast and mixed with the soil either by harrowing or cultivating.

In large quantities, salt is an element of sterility, because of the chlorine it contains.

Nitrate of Soda.

This salt commonly known as "Chilian Saltpeter," is found in large quantities in certain countries that are almost rainless. It is found in South America, and in the western sections of the United States.

It is valuable as a fertilizer for the nitrogen it contains, of which it is a cheap source. It is not important because of its soda, indeed, as I have stated before, it is seldom necessary to

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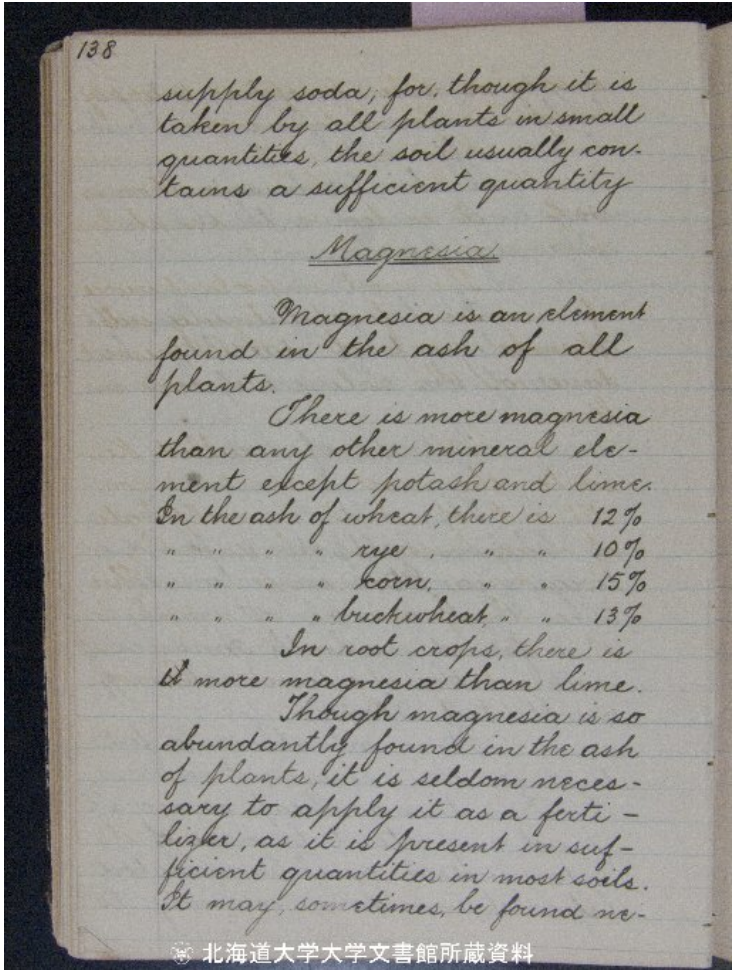


supply soda; for, though it is taken by all plants in small quantities, the soil usually contains a sufficient quantity.

Magnesia.

Magnesia is an element found in the ash of all plants.

There is more magnesia than any other mineral element except potash and lime.

In the ash of wheat, there is 12%

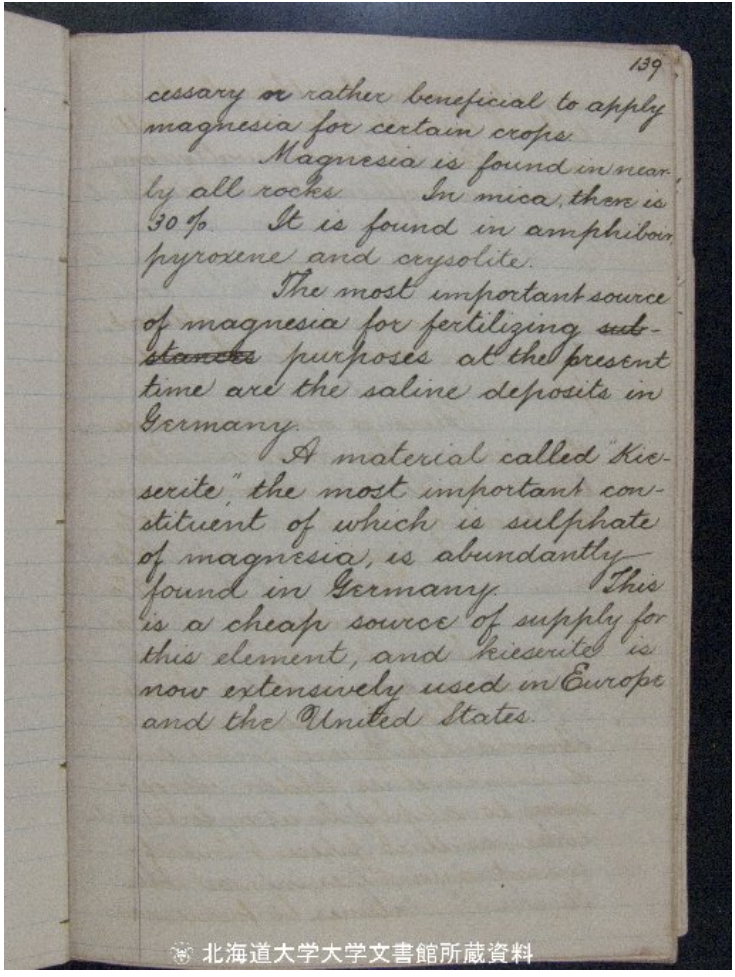
〃 〃 〃 〃 rye, 〃 〃 10%

〃 〃 〃 〃 corn, 〃 〃 15%

〃 〃 〃 〃 buckwheat, 〃 〃 13%

In root crops, there is more magnesia than lime.

Though magnesia is so abundantly found in the ash of plants, it is seldom necessary to apply it as a fertilizer, as it is present in sufficient quantities in most soils. It may, sometimes, be found necessary

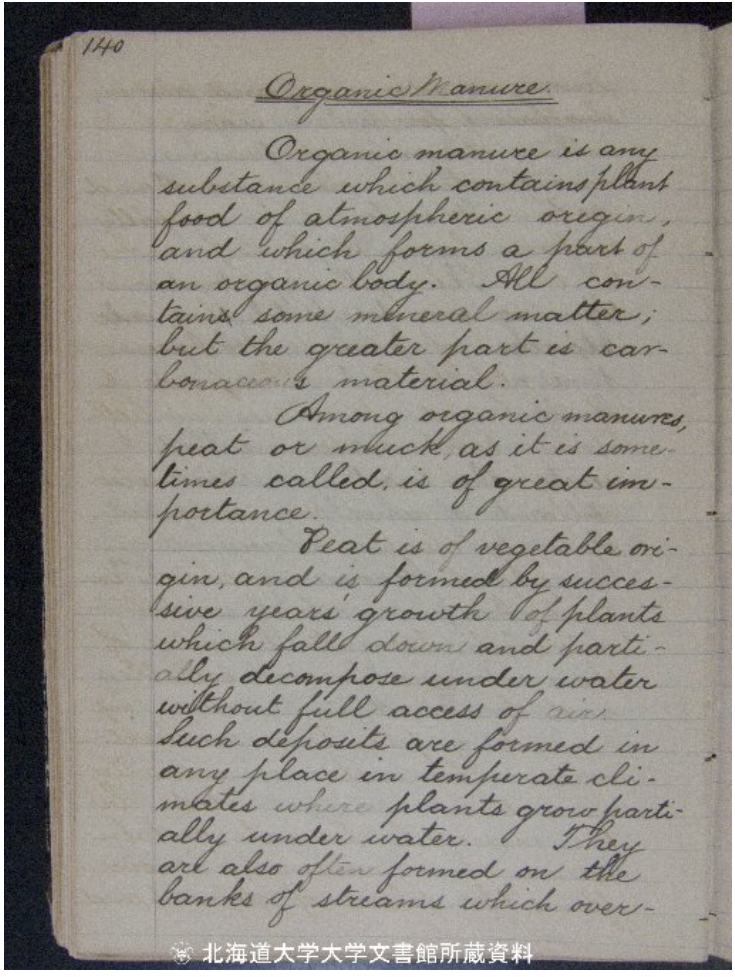


or rather beneficial to apply magnesia for certain crops.

Magnesia is found in nearly all rocks. In mica, there is 30%. It is found in amphiboir pyroxene and crysolite.

The most important source of magnesia for fertilizing purposes at the present time are the saline deposits in Germany.

A material called “Kieserite”, the most important constituent of which is sulphate of magnesia, is abundantly found in Germany. This is cheap source of supply for this element, and kieserite is now extensively used in Europe and the United States.

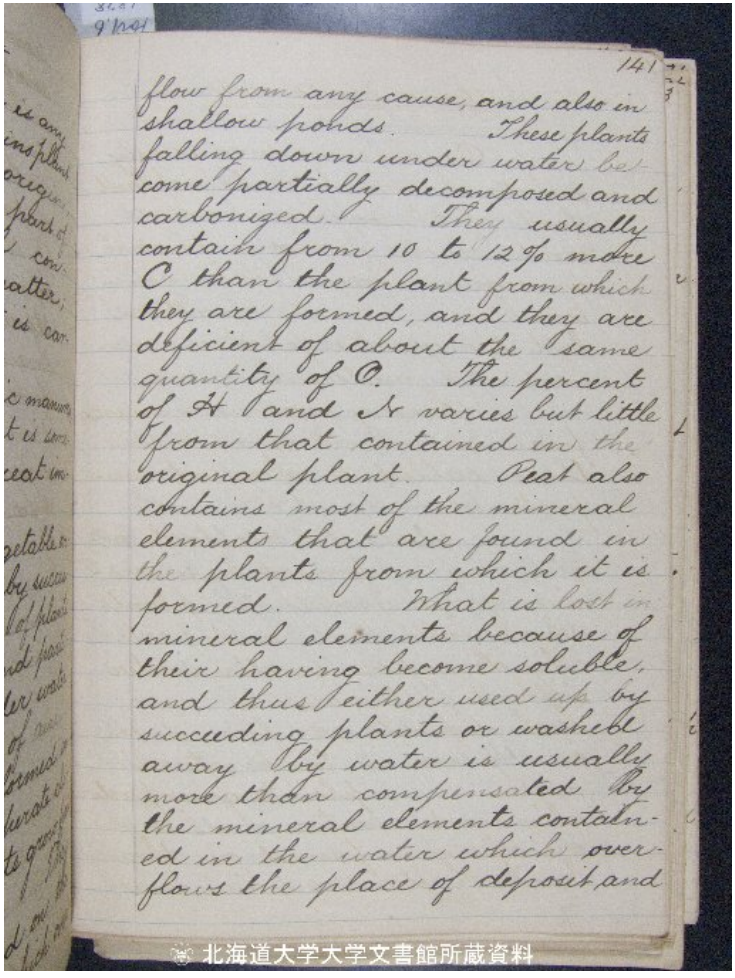


Organic Manure.

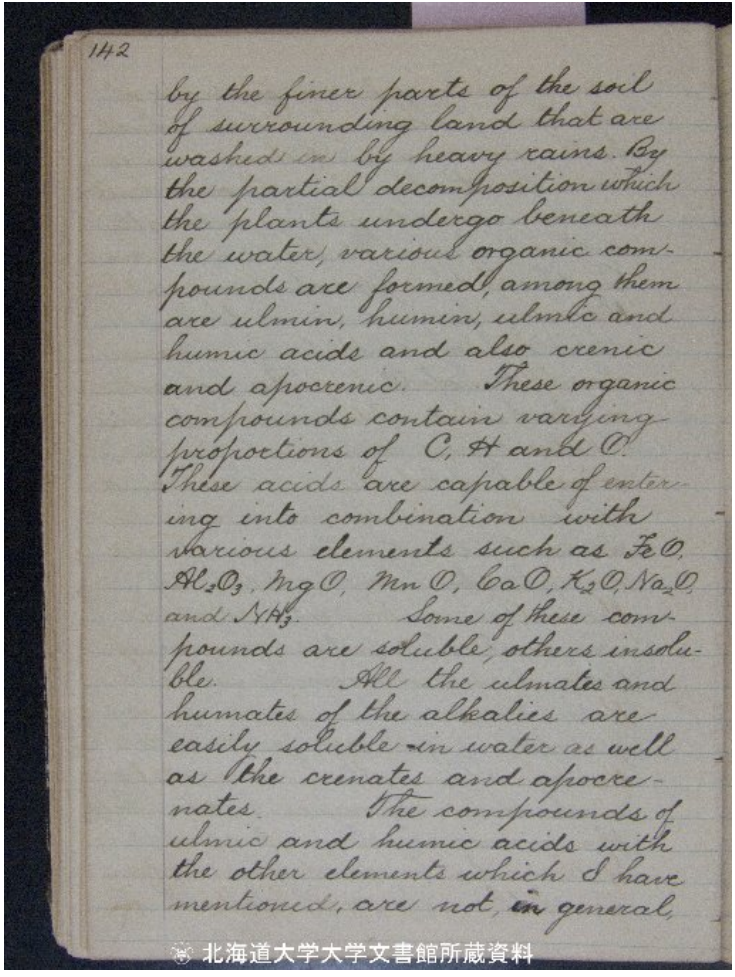
Organic manure is any substance which contains plant food of atmospheric origin, and which forms a part of an organic body. All contain some mineral matter; but the greater part is carbonaceous material.

Among organic manures, peat or muck, as it is sometimes called, is of great importance.

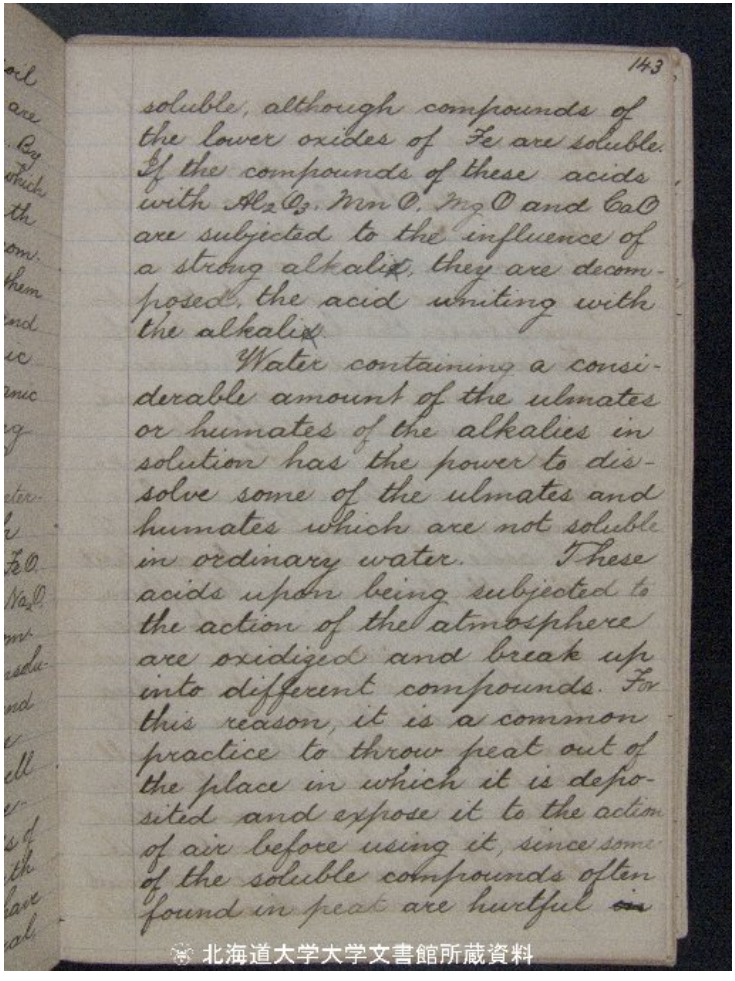
Peat is of vegetable origin, and is formed by successive years growth of plants which fall down and partially decompose under water without full access of air. Such deposits are formed in any place in temperate climates where plants grow partially under water. They are also often formed on the banks of streams which overflow



from any cause, and also in shallow ponds. These plants falling down under water be come partially decomposed and carbonized. They usually contain from 10 to 12% more C than the plant from which they are formed, and they are deficient of about the same quantity of O. The percent of H and N varies but little from that contained in the original plant. Peat also contains most of the mineral elements that are found in the plant from which it is formed. What is lost in mineral elements because of their having become soluble, and thus either used up by succeeding plants or washed away by water is usually more than compensated by the mineral elements contained in the water which overflows the place of deposit and

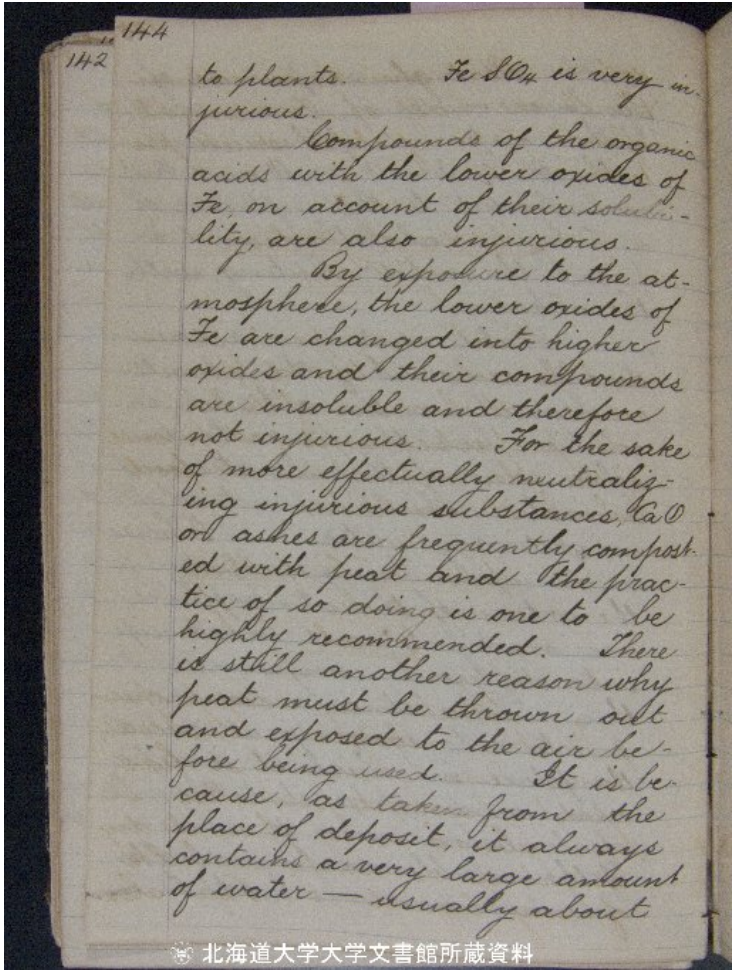


by the finer parts of the soil of surrounding land that are washed in by heavy rains. By the partial decomposition which the plants undergo beneath the water, various organic compounds are formed, among them are ulmin, humin, ulmic and humic acids and also crenic and apocrenic. These organic compounds contain varying proportions of C, H and O. These acids are capable of entering into combination with various elements such as FeO, Al_2O_3, MgO, MnO, CaO, K_2O, Na_2O, and NH_3. some of these compounds are soluble, others insoluble. All the ulmates and humates of the alkalies are easily soluble in water as well as the crenates and apocrenates. The compounds of ulmic and humic acids with the other elements which I have mentioned, are not, in general,



soluble, although compounds of the lower oxides of Fe are soluble. If the compounds of these acids with Al_2O_3, MnO, MgO and CaO are subjected to the influence of a strong alkali, they are decomposed, the acid uniting with the alkali.

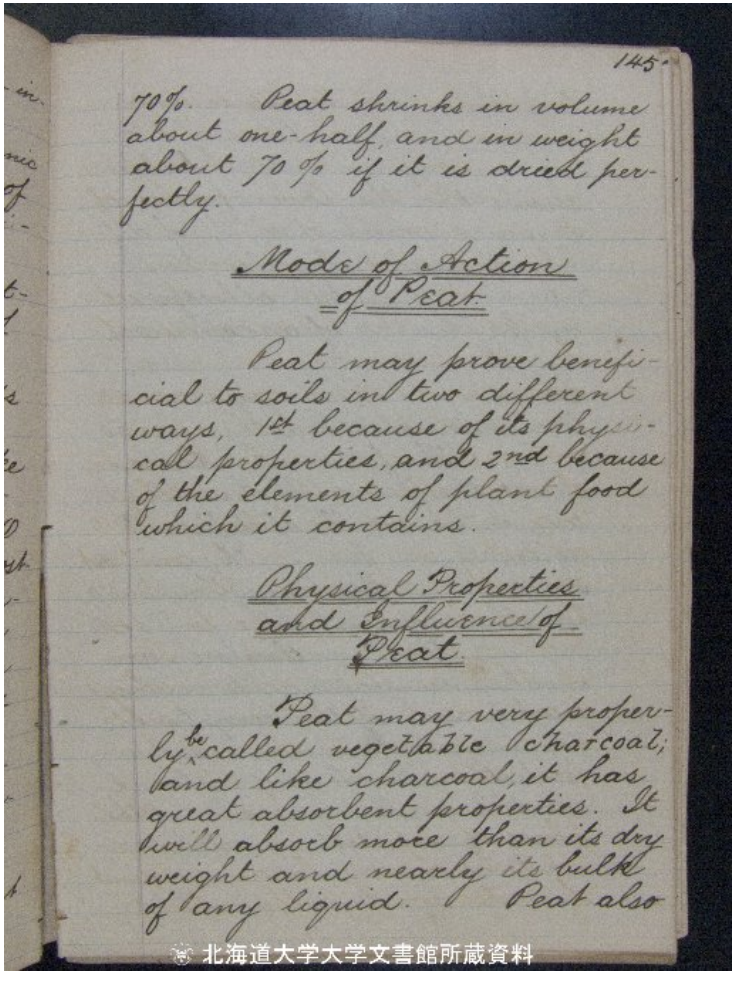
Water containing a considerable amount of the ulmates or humates of the alkalies in solution has the power to dissolve some of the ulmates and humates which are not soluble in ordinary water. These acids upon being subjected to the action of the almosphere are oxidized and break up into different compounds. For this reason, it is a common practice to throw peat out of the place in which it is deposited and expose it to the action of air before using it, since some of the soluble compounds often found in peat are hurtful



to plants. $FeSo_4$ is very injurious.

Compounds of the organic acids with the lower oxides of Fe, on account of their solubility, are also injurious.

By exposure to the atmosphere, the lower oxides of Fe are changed into higher oxides and their compounds are insoluble and therefore not injurious. For the sake of more effectually neutralizing injurious substances, CaO or ashes are frequently composted with peat and the practice of so doing is one to be highly recommended. There is still another reason why peat must be thrown out and exposed to the air before being used. It is because, as taken from the place of deposit, it always contains a very large amount of water —— usually about



70%. Peat shrinks in volume about one-half, and in weight about 70% if it is dried perfectly.

Mode of Action of Peat

Peat may prove beneficial to soils in two different ways, 1st because of its physical properties, and 2nd because of the elements of plant food which it contains.

Physical Properties and Influence of Peat

Peat may very properly be called vegetable charcoal; and like charcoal, it has great absorbent properties. It will absorb more than its dry weight and nearly its bulk of any liquid. Peat also

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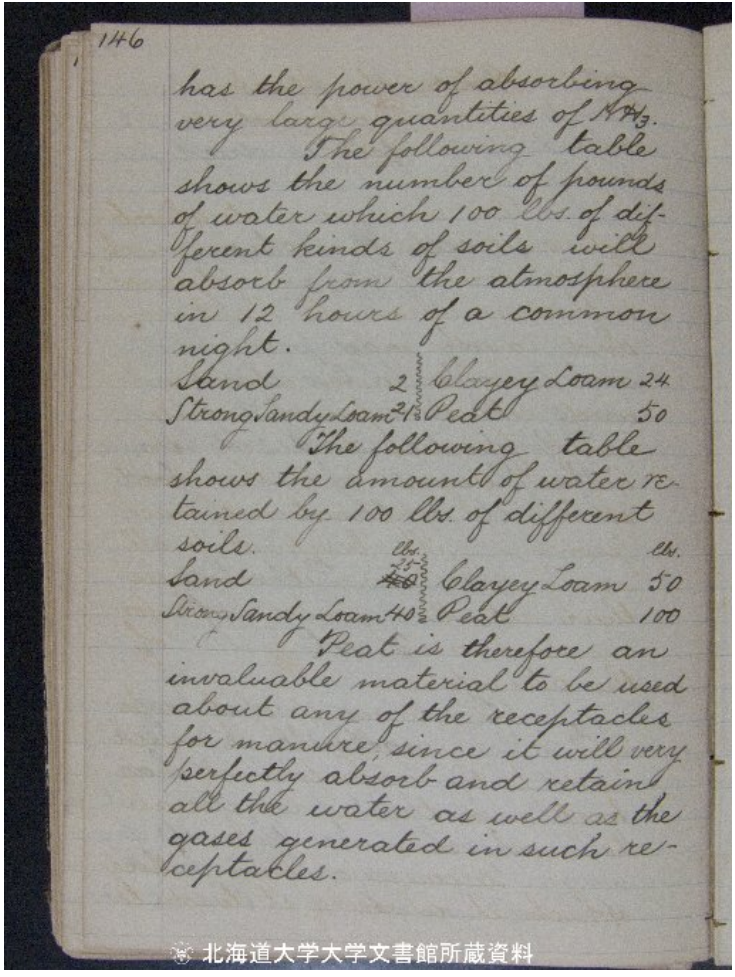


has the power of absorbing very large quantities of NH_3.

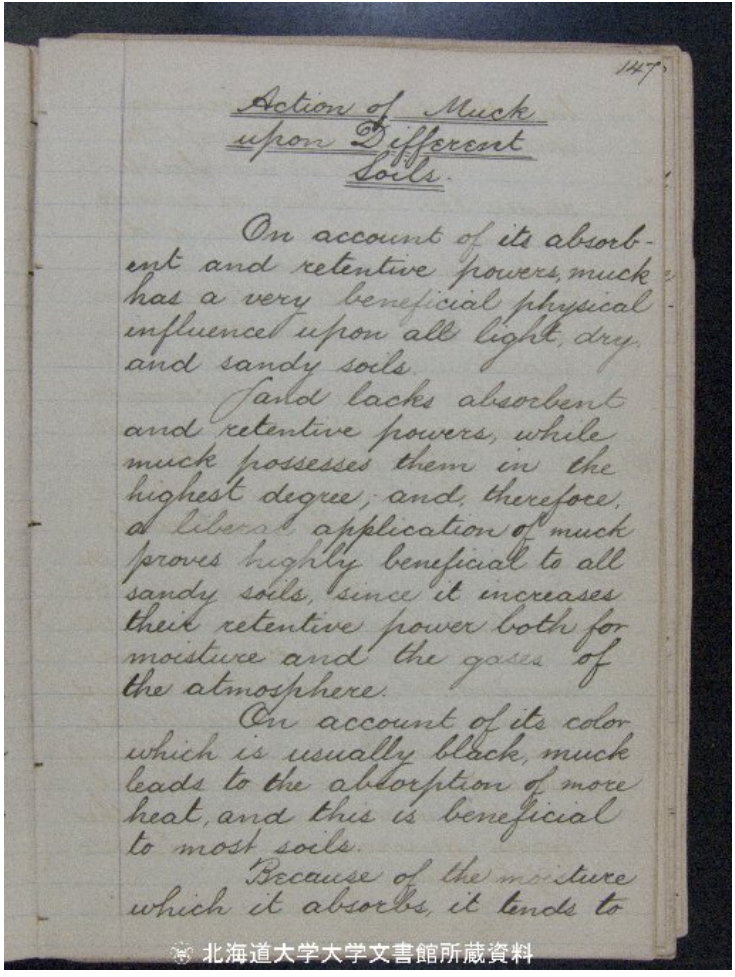
The following table shows the number of pounds of water which 100 lbs. of different kinds of soils will absorb from the atmosphere in 12 hours of a common night.

Sand	2	Clayey Loam	24
Strong Sandy Loam	21	Peat	50

The following table shows the amount of water retained by 100 lbs. of different soils.

	lbs.		lbs.
Sand	25	Clayey Loam	50
Strong Sandy Loam	40	Peat	100

Peat is therefore an invaluable material to be used about any of the receptacles for manure, since it will very perfectly absorb and retain all the water as well as the gases generated in such receptacles.



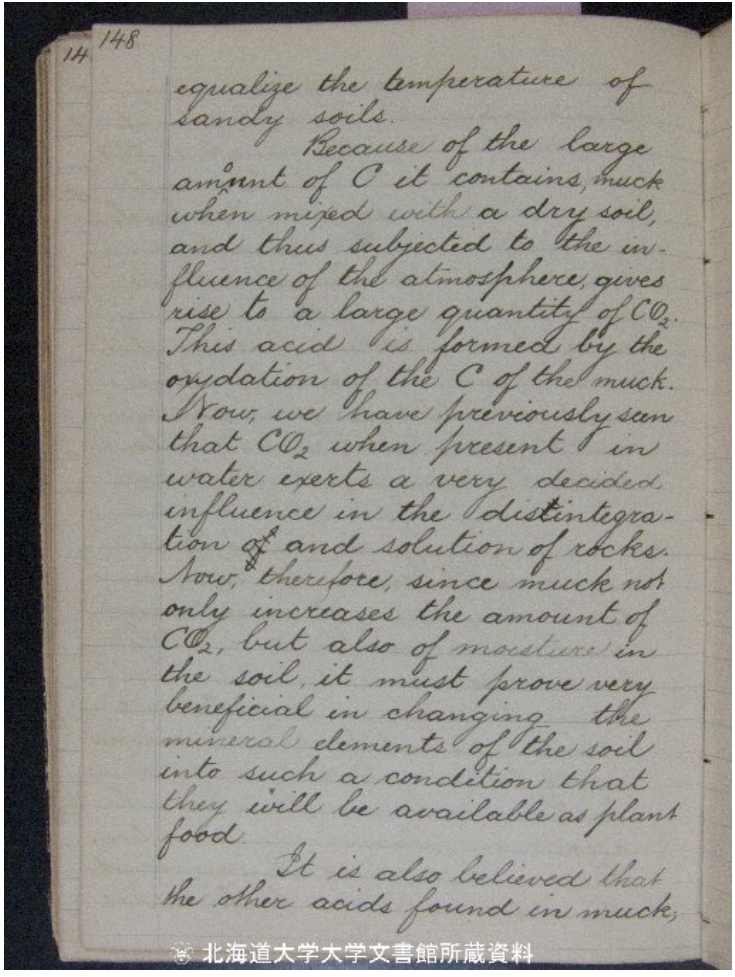
Action of Muck
upon Different
Soils.

On account of its absorbent and retentive powers, muck has a very beneficial physical influence upon all light, dry, and sandy soils.

Sand lacks absorbent and retentive powers, while muck possesses them in the highest degree; and, therefore, a liberal application of muck proved highly beneficial to all sandy soils, since it increases their retentive power both for moisture and the gases of the atmosphere.

On account of its color which is usually black, muck leads to the absorption of more heat, and this is beneficial to most soils.

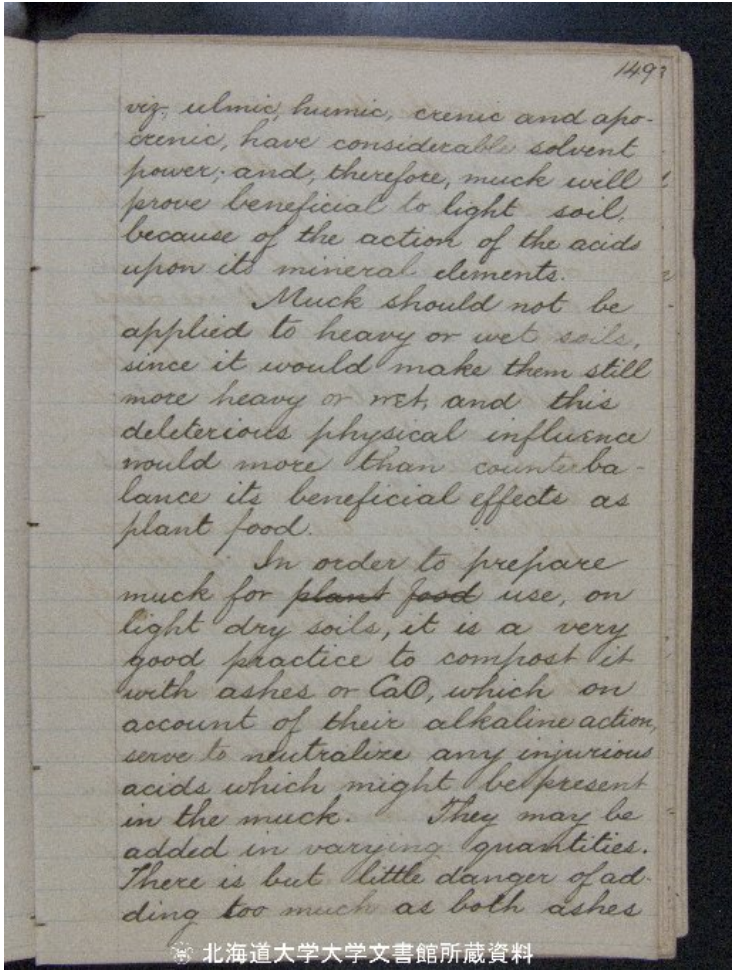
Because of the moisture which it absorbs, it tends to



equalize the temperature of sandy soils.

Because of the large amount of C it contains, muck when mixed with a dry soil, and thus subjected to the influence of the atmosphere, gives rise to a large quantity of Co_2. This acid is formed by the muck. Now, we have previously sun that Co_2 when present in water exerts a very decided influence in the disintegration and solution of rocks. Now, therefore, since muck not only increases the amount of Co_2, but also of moisture in the soil, it must prove very beneficial in changing the mineral elements of the soil into such a condition that they will be available as plant food.

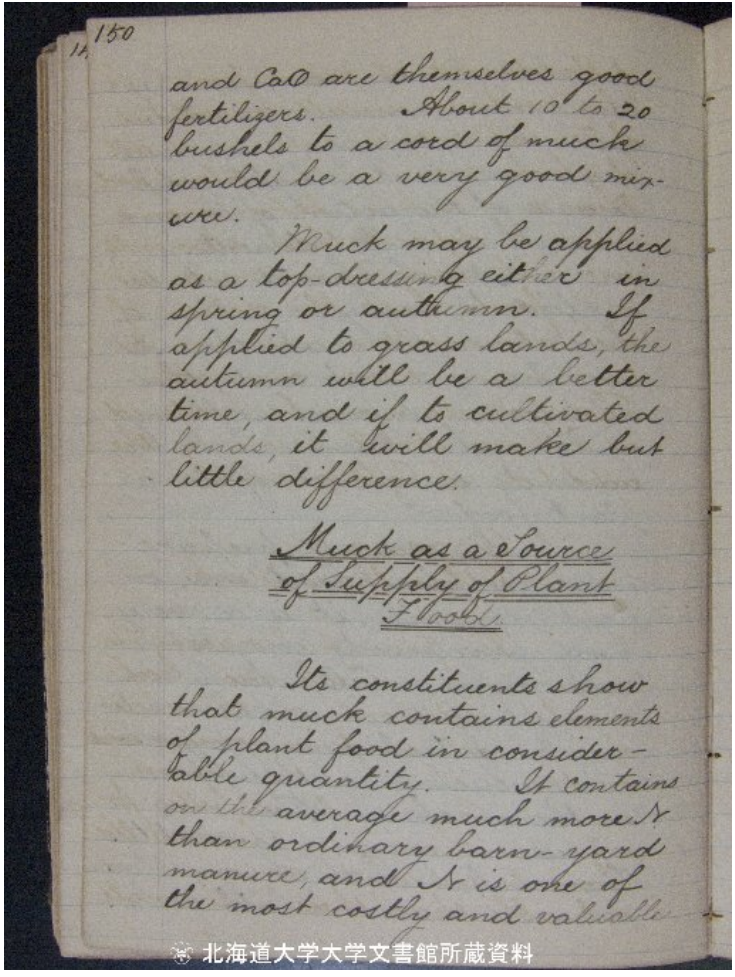
It is also believed that the other acids found in muck;



viz., ulmic, humic, crenic and apocrenic, have considerable solvent power; and, therefore, muck will prove beneficial to light soil, because of the action of the acids upon its mineral elements.

Muck should not be applied to heavy or wet soils, since it would make them still more heavy or wet, and this deleterious physical influence mould more than counterbalance its beneficial effects as plant food.

In order to prepare muck for use, on light dry soils, it is a very good practice to compost it with ashes or CaO, which on account of their alkaline action, serve to neutralize any injurious acids which might be present in the muck. They may be added in varying quantities. There is but little danger of adding too much as both ashes

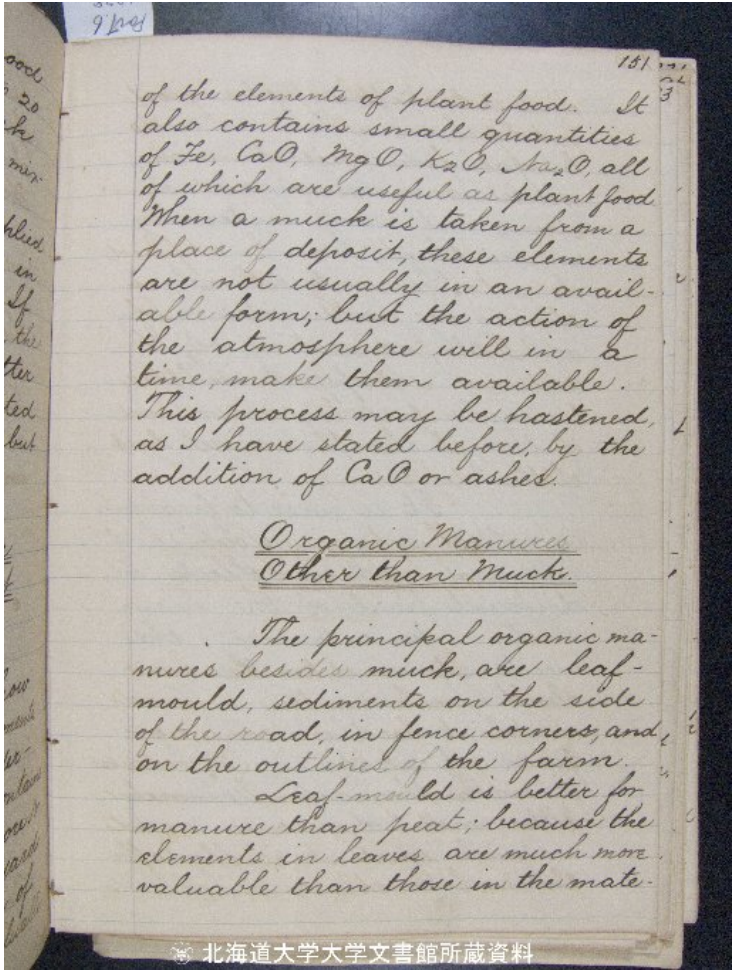


and CaO are themselves good fertilizers. About 10 to 20 bushels to a cord of muck would be a very good mixture.

Muck may be applied as a top-dressing either in spring or autumn. If applied to grass lands, the autumn will be a better time, and if to cultivated lands, it will make but little difference.

Muck as a Source of Supply of Plant Food.

Its constituents show that muck contains elements of plant food in considerable quantity. It contains on the average much more N than ordinary barn-yard manure, and N is one of the most costly and valuable

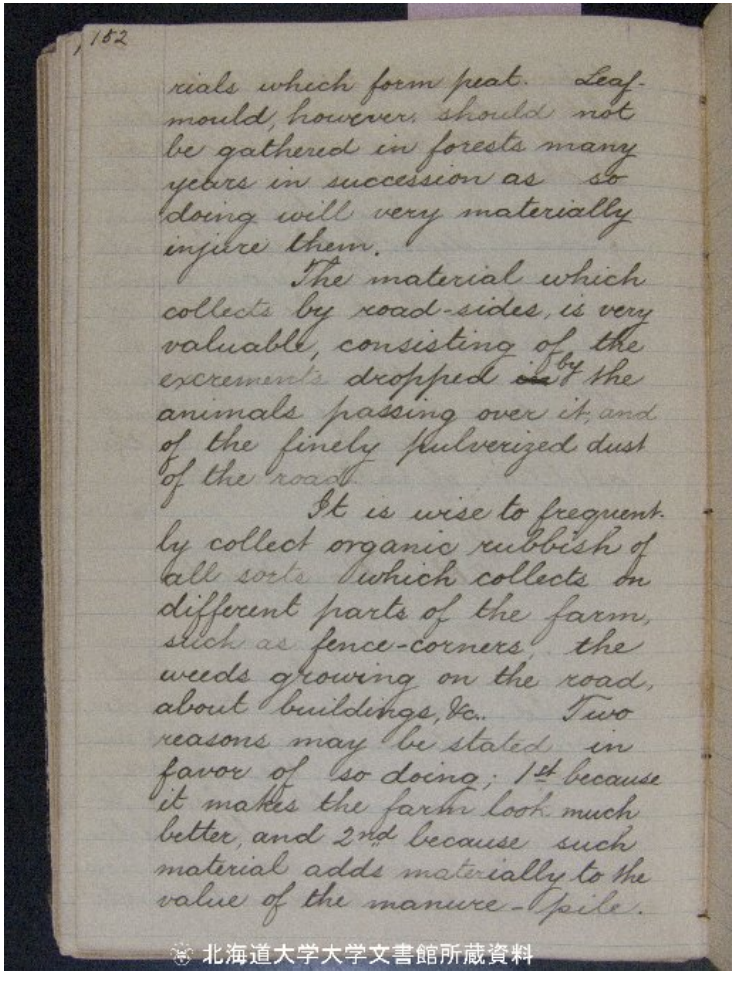


of the elements of plant food. It also contains small quantities of Fe, Cao, MgO, K_2O, Na_2O, all of which are useful as plant food. When a muck is taken from a place of deposit, these elements are not usually in an available form; but the action of the atmosphere will in a time, make them available. This process may be hastened, as I have stated before, by the addition of CaO or ashes.

Organic Manures
Other than Muck.

The principal organic manures besides muck, are leaf-mould, sediments on the side of the road, in fence corners, and on the outlines of the farm.

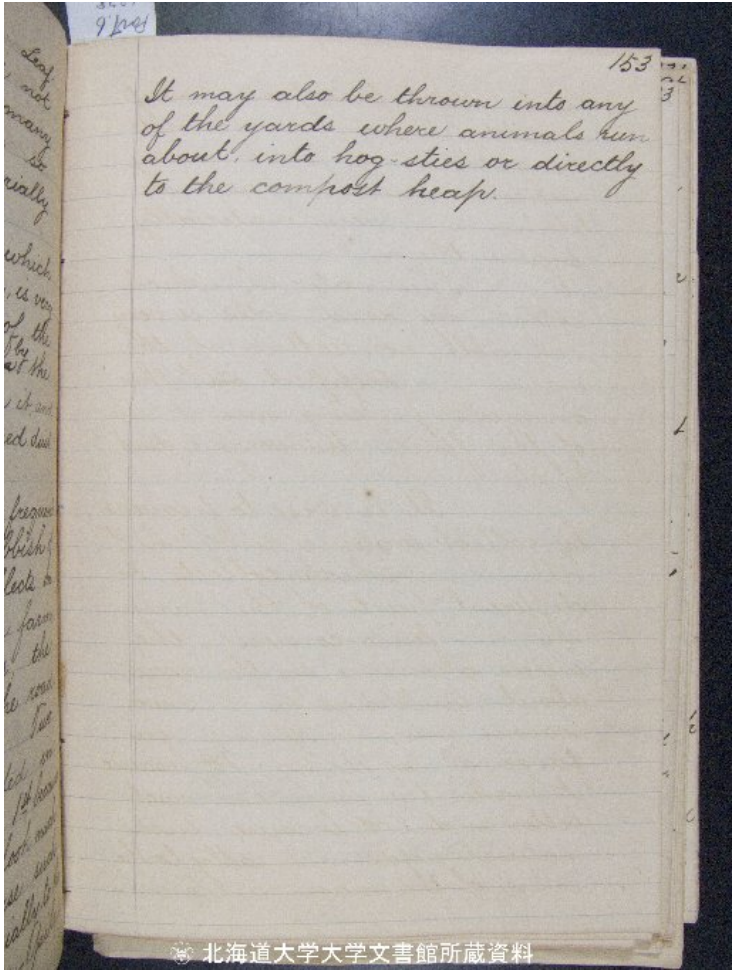
Leaf-mould is better for manure than peat; because the elements in leaves are much more valuable than those in the materials



which form peat. Leaf-mould, however, should not be gathered in forests many years in succession as so doing will very materially injure them.

The material which collects by road-sides, is very valuable, consisting of the excrements dropped by the animals passing over it, and of the finely pulverized dust of the road.

It is wise to frequent by collect organic rubbish of all sorts which collects on different parts of the farm, such as fence-corners, the weeds growing on the road, about buildings, &c.. Two reasons may be stated in favor of so doing; 1st because it makes the farm look much better, and 2nd because such material adds materially to the value of the manure-pile.



It may also be thrown into any of the yards where animals run about, into hog-sties or directly to the compose heap.