WOOD ASHES

AND THEIR USE.

BY T. GREINER,

Author of "PRACTICAL FARM CHEMISTRY," "HOW TO MAKE THE GARDEN PAY," ETC., ETC.

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CROP OF TOBACCO.

From a photograph taken on the farm of MR. J. H. MCGRATH, Hadley, Massachusetts, August, 1894.

UNLEACHED ASHES FROM MUNROE, LALOR & CO. THE ONLY FERTILIZER USED.

WOOD ASHES AND THEIR USE

A PRACTICAL TREATISE ON THE

VALUE AND USE OF WOOD ASHES.

BY T. GREINER,

Author of "PRACTICAL FARM CHEMISTRY;" "HOW TO MAKE THE GARDEN PAY;" "THE NEW ONION CULTURE," ETC., ETC.

PUBLISHED BY

MUNROE, LALOR & CO.

WHOLESALE DEALERS IN FERTILIZERS
AND IMPORTERS OF

CANADA UNLEACHED HARDWOOD ASHES,

OSWEGO, N. Y.

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PUBLISHERS' GREETING.

No apology is due to the reader for this attempt to publish and disseminate among soil-tillers Mr. T. Greiner's treatise on the use of wood ashes as a fertilizer. The people for whose perusal this pamphlet is intended—farmers, gardeners, fruit-growers—bring to the study of the fertilizer question a live interest and a keen understanding. That plant foods must be used, and this with a liberal hand, in the task of trying to make the most out of their soil and their opportunities, is admitted by all. The only problem now before the soil-tiller concerns the proper selection of the plant foods. The question of all questions is, *what materials* to use in order to secure the largest possible effects at smallest possible cost, and the next question, where to get these materials.

We are interested in wood ashes. We believe in them. We have unlimited facilities for collecting and handling them. Our own experience, and that of parties to whom we have furnished wood ashes, have made us enthusiastic advocates of their use, and convinced us that in unleached wood ashes we have one of the best and cheapest, and certainly the most natural, of all fertilizers. It is just the material for supplying plant foods to farm, garden, and fruit crops at low cost, and with a certainty of good effects.

Our business is to furnish you the wood ashes; yours is to use them wisely. And in order to show you how to use them as the "right thing in the right place," and not as other fertilizers are so often used—namely, as the right thing in a wrong place—we have asked Mr. T. Greiner to tell you what he knows about the value and use of ashes. As a student of the sources of

plant foods, their effects and proper modes of application, as a practical farmer who has watched the effects of all sorts of manures on all sorts of crops, and as a popular writer and editor (too well known to need any special reference to his work and writings), he should be supposed not only to be well acquainted with all the details of this subject, but also to know how to tell what he has to tell convincingly and instructively.

We are sure that you need and will want ashes. We are equally sure that we are just the parties best situated to supply you. Two members of our firm live in Canada—F. R. Lalor at Dunnville, Ont., and John Joynt at St. Helens, Ont.,—and both give their personal attention to the gathering and shipping of the ashes; consequently we know what our ashes are, and can guarantee their high quality.

Having had more than twenty years experience in the handling of wood ashes for fertilizing purposes in different States of the Union, we find this trade especially satisfactory. The question, Do fertilizers pay? which is being discussed year after year, and brings complaint after complaint to the manufacturer and seller of the ordinary "artificial" or manufactured manures, is seldom or never raised in regard to ashes. Everyone can see the effects when he applies wood ashes, and everyone admits that ashes pay.

HOW OUR ASHES ARE GATHERED.

Our ashes are gathered from house to house in a dry condition, and containing more or less charcoal (as do all wood ashes), are stored up in large ash-houses erected for that purpose, perhaps for months, awaiting shipment. They go through first a heating, then a sweating process, during which the chemical action of the potash and lime upon the charcoal pulverizes most of it so finely that but a small quantity remains

to be seen. At the same time, most of the charcoal being thoroughly disintegrated by this chemical action, thus serves as a reservoir for the soluble and gaseous constituents of the ashes, which are then in a fitter state to nourish the plant; so that when we ship the ashes we find they have settled down about one-fifth from what they were when gathered in. After this heating and sweating process has taken place, while our ashes have diminished in bulk they have become much more valuable and less bulky than ashes are when first gathered, containing, as they do, larger quantities of potash, phosphoric acid and lime in a more concentrated form, and are in the best possible condition for agricultural purposes.

The ashes when first gathered in weigh from 34 to 40 pounds per bushel, but after going through the heating and sweating process they shrink away about one-fifth, and require considerable more ashes for a bushel than when first gathered. This causes them to weigh from 40 to 48 pounds per bushel by the time they reach their destination, and measure from 44 to 50 bushels to the ton. There is sometimes quite a difference in the bulk of ashes in a ton when gathered and when shipped, although there is no material difference in the quantity of fertilizing elements contained in either, as the difference is caused by one lying longer than the other, thus being better prepared for a quick action on the soil and crop. It takes about 30 cords of hardwood to produce one ton of unleached ashes. In other words, every carload of ashes represents from 300 to 500 cords of wood. This gives an idea of the large plant growth in a ton of our unleached wood ashes. It is not the bulk that is required in an article, but it is *strength* and *value* in a concentrated form. A gold dollar will buy as much upon the market as a silver dollar, and is very much lighter to carry.

MUNROE, LALOR & CO.,

OSWEGO, N. Y.

I.

WOOD ASHES AS NATURE'S FERTLIZER.

Old settlers who have cut down the original forests and burned up the trees, body, top and all, to clear the land for cropping, should be able to tell you something of the practical value of wood ashes. But possibly they did not dream that the thrifty growth on the "virgin" soil and the long maintenance of the original fertility without outside applications were founded, in part, on the fact that the burned trees and shrubs had given back to the soil in their ashes about all that they had taken from it in the course of generations.

Early Observations.

We who have chopped down trees and worked them up for lumber or firewood, could see only the great brush-heaps go up in smoke, and then wonder, first about the small layer of loose, light ashes that were all that was left of the big heaps, and next about the thrifty growth of vegetation that sprung, phœnix-like, out of the little bit of ashes.

Observations of this kind have given us a pretty high idea of the value of ashes as a fertilizer, and some of us have tried to make practical application of the lesson. One of the primitive instances of such application has often been told. It is not unusual for the grower of plants, especially of tobacco plants, to burn a brush-heap in a suitable spot, then spade up the ground, mixing the ashes well with the soil, and sow the seed for plants right there. This must be a reasonably successful method, otherwise it would not be so generally employed.

But let us inquire a little closer into the changes resulting from the process of combustion. In the wood and in vegetation

generally we have a great quantity of bulk; the resulting ashes, on the other hand, consist of a few pounds of mineral or earthy matter. The great bulk has disappeared, but with it only very little that is of real value to plant growth. In the ashes we have the frame-work, the substance. What is gone up in smoke is mostly mere filling, consisting of materials that are plentiful everywhere. What are they? Carbon, of which the earth and the atmosphere and the water contain a bounteous supply everywhere, and which in combination with lime forms whole mountains and mountain systems; then oxygen and hydrogen, the combination of which (water) forms rivers and oceans, and comes down freely from the clouds.

Bulk and Substance.

The only valuable thing, in short, which is lost by the burning process, is a small quantity of nitrogen. Its loss is a real loss, although the gaseous substance is also plentiful everywhere, the atmosphere itself consisting of four-fifths of nitrogen and one-fifth of oxygen. But while all plants can help themselves freely to carbon (as carbonic acid, etc.), and to oxygen and hydrogen (in water, etc.), there are only a few, notably the leguminous plants, like clover, peas, etc., which are able to make use of this atmospheric nitrogen. By growing some of these plants, however, as demanded by good farm rotation, we have it in our power to regain the lost nitrogen in a cheaper way than can ordinarily be done by its purchase and application in commercial fertilizers.

The plant foods which, coming from the soil, are taken up by cultivated plants and removed with them from the soil, and which we cannot replace by any other means save in the application of manurial substances, are potash and phosphoric acid. When these two substances are getting to be scarce in the soil, profitable crop production must cease, and can only be re-established

Importance of Mineral Plant Foods.

by their application to the soil. These two substances are the ones about which the soil-tiller must be chiefly concerned.

Fortunately, these mineral plant foods cannot be destroyed or driven off by fire. Every bit of potash and phosphoric acid, and of all other minerals besides, existing in vegetation, is still found in the comparatively small quantity of ashes obtained by burning that vegetation. In applying the ashes, therefore, we return pretty nearly all the materials of real value which the crops have removed, and the fine results often obtained are herein readily accounted for.

Now let me give a little quotation from my *Practical Farm Chemistry:*

"The many letters annually received by agricultural editors, inquiring about the fertilizing powers of wood ashes, show that the great value of wood ashes as a fertilizer is not yet generally recognized. A fair average sample of ashes made from hickory, beach, maple and oak, etc., contains about 7 per cent of potash and 2 per cent of phosphoric acid. Potash exists here in a readily soluble form and thus is immediately available for plant food. This accounts for the prompt and often astonishing effect that applications of wood ashes usually have upon plant growth, and justifies us in placing the value of this fertilizer much above the result of mere multiplication and addition on the basis of the analysis. The farmer can better afford to pay $15 per ton for wood ashes answering the above analysis than the usual rates for almost any commercial fertilizer."

Effectiveness of Ashes Explained.

This latter point I wish to emphasize. Being directly derived from woody or other plant growth, the plant foods in ashes seem to be especially fitted to re-enter plant structure. Wood ashes are nature's own fertilizer, and their usually pronounced effect only proves the great superiority of nature's over man's workmanship and manufacturing skill.

The reader who, perhaps, has some experience in leaching wood ashes for domestic soap making, has found how easily the

potash in wood ashes dissolves in clear water. Yet, after all the potash that water can dissolve is apparently taken out by leaching, the remaining leached ashes have yet a far greater fertilizing value than might be supposed from their analysis. This in part accounts for the long period during which the effect of applications may be noted. In some instances, to my knowledge, a burned brush-heap or a little pile of ashes has marked its location annually for thirty years by larger and thriftier plant growth than found all around it. Probably such an effect is due not merely to potash and phosphoric acid, but also to its other mineral constituents, notably the lime, which forms the great bulk of ashes, and appears in the best possible shape for aiding plant growth and chemical action. Wood ashes, as Prof. Goessman, of the Massachusetts Agricultural College, says, undoubtedly "supply not only known but also unknown deficiencies in valuable soil constituents." Possibly, also, one of the reasons why ashes show such wonderful effects may be found in the presence of particles of charcoal.

Lasting Effects

Again I wish to quote a paragraph from *Practical Farm Chemistry:*

"Although it is true that charcoal, being insoluble in water, cannot directly enter into the circulation of plant sap, and that plants can depend upon the atmosphere for almost the whole of their carbon supply, if necessary, yet the application of pulverized charcoal or other finely divided carbon in its elementary form, shows often remarkable effects upon plant growth. This is to be explained otherwise than on the theory that the elementary carbon can be utilized as plant food. Charcoal is exceedingly porous. Like other porous substances, it possesses the power of absorbing and condensing gases. Hop-growers know what a large bulk of dried hops can be condensed into the space of a bale by means of a good hop-press; but a hop-press is next to powerless when you compare it with charcoal. This substance will absorb and

What Charcoal Does.

condense in itself 90 times its own bulk of ammonia, 35 times its own bulk of carbonic acid, besides large quantities of various other gases. It catches plant foods, and brings and holds them for the use of vegetation. The precious but volatile ammonia is not only held but brought in immediate contact with oxygen, all condensed in the charcoal pores, and changed into the stable nitric acid, etc.

"On the whole, I think that carbon occupies a position of greater importance in the economy of plant growth and profitable plant feeding than is assigned to it by a majority of farm writers, or than might be inferred from the fact that no quotable value is conceded to it, or that it is entirely left out in the computation of commercial value of manures."

There are still other beneficial effects of the application of wood ashes not yet mentioned, effects which often aid materially in the production of increased plant growth. One is the mechanical improvement of many soils to which ashes have been applied. "As mellow as an ash-heap" is an old comparison; and this mellowness and porosity are often transmitted to hard and lifeless soils by the ashes. Even the leached ashes which one finds lying about unappreciated on the premises of rural people, are worth gathering and putting on the land alone for this effect, even if they were not worth consideration for many other reasons. Of the value of wood ashes in protecting crops from the ill effects of protracted drouths I shall speak more fully later on.

Mechanical Effect.

THE CONSTITUENTS OF WOOD ASHES.

Speaking more fully on the constituents of wood ashes, I will name first the following four alkalies—potash, soda, lime, and magnesia:

POTASH.—This is the most important of the plant foods. Wood ashes contain between 5 and 9 per cent of it, mostly in

the form of carbonate of potash, the most valuable of all for the purposes of plant feeding.

From an earlier pamphlet on wood ashes I will simply quote the following:

"Being very caustic, it (potash) is an active agent in the decomposition of vegetable matter. It unites with silica and forms a compound which water can dissolve and carry down to the roots of plants, thus supplying the plant with an ingredient which gives it a coating and strength. It roughens the smooth, round particles of sandy soil and prevents them from compacting together, as they are liable to do. It makes the soil finer, softer, and darker in color. It assists it to hold moisture and to withstand drouth."

SODA.—Wood ashes also contain a small percentage of soda. This has been found to possess considerable value, at least under some circumstances and for some crops, like beets, spinach, etc. Its effect has often been so marked that certain writers, even at the present time, claim (erroneously, however,) that soda can take the place of potash in plant nutrition.

LIME.—A large share of the bulk of wood ashes—namely, about 35 per cent of its weight—consists of lime, an alkaline earth, chiefly in the form of carbonate, to a small extent in the form of the valuable phosphate of lime. The great agricultural value of lime, even when derived from dead stone, is pretty generally recognized by all farmers, even by those who do not believe in "fertilizers." The lime in ashes, however, has acquired new life, by "having already gone through the chemical changes in the vegetable organism. It is in a finer state of division, therefore more easily soluble and readily assimilated by the plant."

MAGNESIA.—This, also found in wood ashes and taken up by plants in small quantities, is the least important of the four alkalies.

ACIDS AND OTHER CONSTITUENTS.

Of the acids we have in wood ashes phosphoric acid and sulphuric acid. The 2 per cent (more or less) of the former are almost as valuable for plant nutrition as the 5 or more of potash, and are especially useful for the production of grains and the development and ripening of seeds generally. The 1 per cent of sulphuric acid aids in catching and "fixing" ammonia, and in unlocking plant foods that are held in insoluble combinations in the soil.

Wood ashes also contain silica, a fine sand which, combined with potash, forms the hard, glossy surface or coating of the stalks of grains and grasses; chlorine, as common salt, which often has a good effect on some soils and crops; oxide of iron or common iron rust, which comes largely from the old nails attached to the boards that were used as kindling; alumina, etc., etc.

II.

WOOD ASHES FOR THE FARM.

At present prices of ordinary farm crops any waste or carelessness in the purchase and application of plant foods must in itself exclude every possibility of profitable production. The farmer of to-day cannot well afford to purchase much nitrogen, the costliest of all plant foods, when intended to furnish the needs of grain crops. Nor is there any particular need of buying nitrogen in any of the commercial forms when it can be drawn from the atmosphere, by means of clover, peas, or other

leguminous crops, without extra cost. On the average farm of the North, red clover is now generally recognized as the chief link in profitable farm crop rotation, and as the chief means of maintaining the fertility of the soil to the point of making the production of other crops, especially grains, remunerative. The judicious use of clover, in short, can alone help the grain farmer over all his difficulties. He makes the best possible use of the top growth by feeding it to his farm animals and returning the manure to the land, and of the stubble and roots by feeding them directly to his soil and crops.

Ashes for Clover.

But while clover is called a "renovator of the soils," and more truthfully an "accumulator of plant foods;" while we concede that it collects and brings to the soil great amounts of atmospheric nitrogen, it also ramifies all through the soil, and even through the subsoil, in search of mineral plant foods, especially of potash, and consumes them far more voraciously than does any other crop. The two tons of clover hay that may be grown on one acre in a single crop, remove from that acre about 93 pounds of potash and 27 pounds of phosphoric acid. If such cropping, varied as it may be in accordance with the demands of proper crop rotation, be continued for any considerable length of time without returns being made for the loss of plant foods by applications of manures of some kind, how long can we expect the supplies in the soil to hold out? Clover is by all means the most exhaustive farm crop, and we might say of it, with even more force than of lime,

> "Clover without manure
> Makes the father rich and the children poor."

It can only be a question of time when the potash and phosphoric acid supplies of the soil become exhausted, and clover

ceases to grow for want of proper food. Then, perhaps, we have the condition so often called "clover sickness," and which in most cases is nothing but lack of potash.

The good farmer aims to feed his grain and potato crops with clover; but in order to get the clover, he must first feed the clover by returning to the land the mineral elements which the crop requires and in part removes from the land. If there is any substance by the application of which this object can be accomplished more certainly, and in most cases more economically, than in wood ashes, I have never heard of it. In 1,500 pounds of good unleached wood ashes we supply more than all the potash and the phosphoric acid needed for the production of the two-ton clover hay crop; and by means of that application we put the clover plants in position to make a strong, vigorous growth and aid them to gorge themselves with elementary nitrogen and with carbon, both of which are so bountifully provided for them in the atmosphere.

Of course, if we feed all our manures (ashes) to the clover, depending on the latter to feed the following grain or other crops, and thus make only one application during the four or five year rotation, heavier dressings should be made and can well be afforded. In fact, I am not disposed to limit the farmer's generosity in this respect. This generosity is wisdom. There can be no grounds to fear that the food elements will leach out of the soil and be lost. They will not. All the potash and phosphoric acid which the ashes supply to the soil will stay there until taken up by plant roots. Even if we use two tons of unleached wood ashes (either in one or divided in several applications) during the four or five year rotation period, we will not likely complain of the comparatively slight cost of the manuring, so long as the land is kept by it in a high state of productiveness.

The case is somewhat different when grains and grass or

other seeds are the chief crops produced, and the long succession is only broken by the occasional interposition of clover.

Bone with Ashes for Grains.

Grains and seeds of all kinds consume considerable quantities of phosphoric acid, and in the long run the usual applications of wood ashes could not be expected to furnish that substance in the full amount required; at least, if we were to use doses heavy enough for all needs, we would at the same time waste a good

OATS WITHOUT ASHES. OATS WITH ASHES.

deal of the valuable potash not needed here in so large amounts. We must try to be economical. By the addition of bone meal to the ashes, or by separate applications of bone meal to the soil, we supply the missing element, and this probably in as cheap and effective a manner as we can expect to do. We should know that in bone meal we have one of the cheapest sources of phosphoric acid, with quite a percentage of nitrogen thrown in. This phosphoric acid, in fine bone, soon becomes

soluble, and at any rate is reasonably available for the use of plants; but the caustic action of the wood ashes soon makes it fully and immediately available. Indeed, the best and most satisfactory method of treating the old and green bones which the farmer may collect on his premises or in his vicinity, to fit them for manure, is by means of putting them in layers with unleached wood ashes, and keeping the whole mass moistened until the bones become softened.

Home Treatment of Bones.

The combination of fine bone and wood ashes, indeed, is a most admirable one. It commends itself to the farmer both for cheapness and effectiveness, and should be employed as a complete and general purpose manure to a much greater extent than is now generally done. The two substances together supply all the needed elements in their best forms, and in well-balanced rations; or they may be mixed in just such proportions as to fit any special conditions and requirements of soil and crop. There may be soils so liberally supplied with potash that further additions will have little effect. In that case, much bone and little wood ashes (and the latter mostly for its solvent effect upon the bone) will be the proper thing. Or there may be soils so liberally supplied with phosphoric acid that its application would not improve things. Then wood ashes alone are needed. And between these two extremes there is a wide range of variations and possibilities.

A Complete Manure for General Use.

Bone contains from 3½ to 4 per cent of nitrogen and 22 per cent of phosphoric acid. Now if we mix about one ton of bone meal with two tons of good unleached wood ashes, we have in the resulting combination a fertilizer analyzing about 4½ per cent potash, 6½ per cent phosphoric acid, and 1½ per cent of nitrogen, and no better nor cheaper manure exists to meet the requirements of the average grain farmer, and average con-

ditions generally. It has a supply of phosphoric acid plentiful enough to satisfy the grain crops most urgently in need of it. A smaller proportion of the bone, say one ton to three or four of the ashes, however, will do in a majority of cases. The free use of these mineral manures will surely result in stiffer haulms (preventing lodging), larger yields, plumper and heavier kernels, and profit and satisfaction generally.

Grasses other than Clover.

Many of my remarks about clover apply to other grasses also. The majority of our meadows and pasture lands are thin and poor. Have you any idea what a great improvement you can make in them by the application of reasonably large quantities of wood ashes? Just try it. Put on a ton or two per acre, and see what a crop of hay and pasture grass full of sweetness and substance you will get. The effects of the wood ashes will reach clear to the milk-pail. The thin crops of poor hay do not pay. The good crops of good hay and grass, full of nourishment, pay well.

For Lawns and Cemeteries.

For the lawn we do not particularly care about a heavy crop of grass. What we want is a close, velvety sward. But this we can only secure by means of thrifty and constant growth. The lawn, to be a thing of beauty, must be well fed. Shall we cover the ground in front of the residence with unsightly filth that stinketh to heaven? Shall we allow our beautiful lawn to be spoiled by noxious weeds, the seeds of which we carted upon it with the manure? Far be it! A few tons of wood ashes per acre for a starter and an annual dressing of a few hundred pounds afterwards will give us all the benefits without the drawbacks of rank manure. We secure the thrifty growth, the dark color, exemption from the ill effects of dry weather, cleanliness, freedom from weeds, etc.

It would be difficult to make this advice too strong to use

wood ashes—and bone if need be—for lawns in place of weedy, ill-smelling, bulky stable manure, but I feel like putting still more emphasis on it when it comes to the use of plant foods for cemeteries and park use. Every intelligent man will see additional reasons for the preference of concentrated, clean manures in such places without having them specially pointed out.

Cemeteries and Parks.

Two farm crops which are especially in need of a good supply of potash in the soil are tobacco and potatoes. How plants of the former are grown in a seed bed fertilized with wood ashes has already been mentioned, and it also gives us the key to the proper feeding of the crop in the field. The leaf and stalk of the plant have as large a percentage of potash as the best of unleached ashes, which fact in itself explains the great effectiveness of wood-ash manuring on the crop. Tobacco is quite particular about the form in which potash is offered to it. In the form of muriate of potash (which contains a great deal of chlorine) potash should

For Tobacco and Potatoes.

not be given, as it would be sure to lower the quality of the leaf greatly. Wood ashes are just exactly what is needed, and may be applied at the rate of two or three tons to the acre in the fall or spring before setting the plants. Light applications may also be made around the plants when setting them. The result of such manuring will be a fine, smooth, silky leaf of desirable color, burning to a beautiful white ash, and an extra price obtained for the crop.

In growing potatoes the method of manuring now recognized as superior to all others is to feed the manure to clover and the

POTATOES WITHOUT ASHES.

POTATOES WITH ASHES.

clover to the potatoes. This, of course, involves the use of wood ashes on the clover. But if additional dressings, directly to the potato crop, are desired (and they are always desirable), we have again nothing to offer to the crop that could be superior to ashes. The carbonate form of potash, which seemed to be so especially congenial to the tobacco crop, is surely no less so to potatoes, and results in the development of starch, making the potatoes cook dry and mealy.

It will hardly be necessary to speak at length about other farm crops and their needs. There is none that I know of which

under average conditions would not be benefited by applications of wood ashes. I have seen the good effects of them on corn, sweet potatoes, tomatoes, etc., and in regard to hops I will simply cite the instance of Mr. H. E. Kinne, who before a farmers' meeting (Otsego County, N. Y.,) told of his fine hop crops of 2,000 pounds to the acre, obtained by means of manuring with a ton of ashes and 500 pounds of phosphates or bone to the acre. "My best yards," he writes, "have had no barnyard manure for the past five years—nothing but ashes and phosphate or bone flour."

For Corn, Hops, Etc.

III.

WOOD ASHES FOR THE MARKET GARDENER.

The well-known faculty of carbonate of potash to attract and hold moisture gives to wood ashes an additional value as a manure for garden crops. The late J. M. Smith, of Wisconsin, a prince among gardeners, used to tell at horticultural meetings, where I often listened to him, how much his crops were benefited in this respect by his liberal use of wood ashes. I think his usual rate of application was 100 bushels to the acre (over two tons).

Ashes Preserve Moisture.

There is still another service which we can expect from heavy wood-ash manuring in the garden—namely, the destruction of some of our most injurious insects, especially flea beetles, cabbage and onion maggots, cut worms, and other grubs and worms infesting the soil. Club root, a fungous disease of cabbages, cauliflowers, and similar plants, will also have little chance in ash-manured soils.

Ashes vs. Insects and Disease.

Ashes for Muck Lands.

Lands of a mucky or peaty character are often used for growing onions, celery, carrots, and other vegetable crops. These soils contain all the nitrogen which the crops planted on them may need. The minerals, however—lime, phosphoric acid, and especially potash—are likely in very scant supply. To maintain or increase the productive capacity of such soils, applications of potash and phosphoric acid in some form are indispensable, while those of nitrogen would in most cases be superfluous, and consequently wasteful. In wood ashes we have the most serviceable and usually the very cheapest manurial substance to meet this emergency. It may be advisable to add a small proportion of bone meal, say 500 pounds to every ton of unleached wood ashes, and thus produce a fertilizer containing about 5 per cent potash and 5 per cent phosphoric acid. For potatoes and root crops even a smaller proportion of bone meal would answer in most cases.

Artificial Stable Compost.

Sometimes the gardener finds it impossible or impracticable to procure what stable composts he may desire to use. If a muck bed is within reach, an artificial substitute for stable manure can easily and cheaply be prepared after the following recipe: Take one ton of dried muck (having about 12 pounds of nitrogen), 200 pounds of unleached wood ashes (having 12 pounds of potash and 3½ pounds of phosphoric acid), and finally 20 pounds of bone meal (having nearly 4½ pounds of phosphoric acid and a trifle less than one pound of nitrogen). Mix and compost. The result will be a valuable garden manure, having about 12 pounds of nitrogen, 10 to 12 pounds of potash, and 7 to 8 pounds of phosphoric acid to the ton, therefore being equal in value and effectiveness to a ton of the best stable manure, and this at the cost of 200 pounds of ashes and 20 pounds of bone meal, plus the labor required in getting out the muck and composting the mixture.

A lengthy separate reference to the requirement of each particular garden crop will not be necessary. Suffice it to say that all of them will be largely benefited, both directly and indirectly, by the application of wood ashes. As an onion grower I have always been in favor of such manuring, and have obtained most satisfactory results from it. But the onion is especially fond of potash, and so are all the root crops. On the whole, I like to put at least two tons of unleached wood ashes to the acre on all my garden land, followed up with lighter annual dressings afterwards. I will add that the New York Experiment Station grew its prize vegetables (exhibited at the World's Fair) mainly by the use of ashes and bone meal—a good showing for this manure, indeed.

Onions and Root Crops.

IV.

WOOD ASHES FOR FRUIT CROPS.

Up to this point half the praises due to wood ashes as a fertilizer have not been sung. We might be able to dispense with wood ashes on the farm and in the garden by substituting other less natural manures for them, but such a course could not easily be reconciled with economy and safety in the management of our orchards and small fruit patches. The great cry of our fruit crops is for *potash, and plenty of it.* It is their first and chief need. Don't imagine, either, as a new apostle of agricultural chemistry is just now trying to make farmers believe, that the cheaper soda can take the place of potash in plant economy. You

Potash the Great Need.

cannot cheat nature by adulterations. Trees want potash as muriate, or sulphate, or nitrate, or, still better, as carbonate of potash; they will not accept sal-soda (carbonate of soda) in place of them. You cannot turn stone into bread. Trees cannot absorb soda and then give it back in their ashes as potash. A fowl will eat pebbles, and the pebbles are a benefit to it as a necessary aid in its proper nutrition. But it would be absurd to claim that pebbles can take the place of grain in feeding poultry. In short, our fruit crops want potash, and they must have it in order to be able to thrive and give satisfactory returns.

Every progressive fruit-grower is aware of this fact. If you ever have been present at the meetings of fruit-growers, say of the Western New York Horticultural Society, at Rochester, as I have been year after year, you have heard the emphatic advice of Barry, and Willard, and Hale, and of all the other great lights in modern fruit culture—men who make money out of this calling—"Feed potash to your fruits."

I am tempted to give a few pages of quotations from the remarks of these expert fruit-growers about the value of potash for fruit crops, but all this may be found in the annual reports of the proceedings and in the columns of the agricultural press. As everybody likes to hear himself talk, however, I will give another paragraph from my *Practical Farm Chemistry:*

"Complaints about the ineffectiveness of applications of bone meal or other plain phosphates or super-phosphates to orchards, vineyards, small fruit patches, and vegetable gardens are nothing at all uncommon. Yet such negative results are just the ones that should have been expected. Why? Because the substances named have little or nothing of value besides phosphoric acid, of which fruit and garden crops require only very small quantities.

"In fruit crops we remove from the soil an amount of potash ten, fifteen, and often more times as large as that of phosphoric

acid. Many farmers imagine that orchards need no manuring. Perhaps a crop of grass, with all its large amount of potash, is taken off besides. With such great and incessant drain on the potash supply, it will not be long before that supply is getting too short to allow healthy growth of tree, vine, or bush, and a full crop of fruit.

"Phosphoric acid is used only in small quantities. For these reasons bone meal, phosphates, etc., *alone* are not what is wanted for a fruit-tree manure. Potash is needed more than any other substance, and unleached wood ashes is one of the best forms—if not *the very best*—in which this can be applied.

"A sufficiency of potash makes bush and tree fruits firmer, sweeter, better in flavor, and renders the wood more resistent to severe cold."

The fact being settled, once for all, that we must supply potash to fruit crops, the next question is, What form is the best to use? Both reasoning and the results of practice will surely point to wood ashes. It seems plain enough that, coming from trees—indeed, being the trees' substance—the plant foods in ashes are in best shape for going back into tree growth. Practical experience confirms this theory. Expert fruit men always speak in high terms of ashes. So write the Hale Bros., the famous peach and small fruit growers of Connecticut, to one of the dealers in Canada ashes:

Wood Ashes Best.

"We have never yet used anything that, for the money expended, gave us such remarkable growth in our young peach orchards; and the wood is now ripening up hard and solid, and gives indications of carrying the fruit buds through the winter in fine condition."

It is not my intention to go separately through the whole list of fruits, giving their special needs and requirements. Let me say, and say it emphatically, that all need *potash, and plenty of it*, and that ash manuring is just the thing they will all delight in and make good returns for. The difference is only one

of degree, and but little of that. But if there is one fruit that is benefited by potash applications more than another, it is the peach; next to it the grape, the orange, the pear, the strawberry, the raspberry, etc. For the cherry and plum, perhaps lighter dressings will answer.

The "unknown deficiencies in valuable soil constituents," which, according to Prof. Goessman, wood ashes supply, or chemical actions and reactions not yet fully understood, often give an especial and often wonderful effect to manuring with wood ashes, especially when given to peach and a few other trees. Many ailing trees, supposed to be dying with the yellows, have been restored to health and usefulness by the application of ashes.

V.

METHODS OF APPLICATION.

The results of experiments in various methods of applying fertilizers, made by me in former years, have invariably led me to the conclusion that quantity of plant foods applied has a good deal more to do in determining the result than has the mode of application. It does not make so very much difference whether we apply the manurial substances to the land before plowing or after plowing, above the seed or below the seed, stir them in with the harrow or with the cultivator or with any other tool, and often whether we put them *on* the soil or *in* the soil, so long as we apply sufficient quantities, and apply them at an opportune time—namely, somewhat ahead of

the moment that the plants will want to take hold of these foods. This experience has converted me to the doctrine of heavy manuring. When I am after extra results in farming, gardening, or fruit-growing, I use extra amounts of manure, and I always find it pays, provided that I select the manure in accordance with the requirements of soil and crop. The heavy yields nowadays are the ones that give the greatest profits, and the heavy yields only come from heavy manuring. From nothing nothing comes, you know. When you ask me, therefore, What is the best method of applying ashes? I would reply, *Use plenty of them.*

Large Applications Desirable

The following general rules may be safely followed for general practice:

General Rules.

1. For the purposes of soil improvement in mixed farming, apply a reasonably heavy dose at the start, say from one to two tons per acre, preferably to the clover crop, in fall, winter, or early spring. Then follow this up with lighter dressings combined with bone meal, according to circumstances, year after year.

2. For the maintenance of farm soil fertility, apply annually from 500 to 1,000 pounds of ashes per acre, in fall, winter, or early spring.

3. For the more valuable farm crops, such as potatoes, tobacco, hops, etc., increase the applications, say up to two or three tons and more per acre. Best time to apply is in fall or winter before, partially to the preceding clover crop.

4. For garden crops, especially onions, beets, carrots, parsnips, turnips, etc., use two tons per acre, applied in fall, winter, or very early in spring. Also use compost, bone meal, nitrates, etc.

5. For fruit crops make annual applications of two tons or more—less, perhaps, while trees and bushes make wood growth

only and are not bearing fruit; more when they bear full crops. A few hundred pounds of bone meal may be safely and wisely added to the ashes.

TURNIPS WITHOUT ASHES.

TURNIPS WITH ASHES.

6. In all cases make the large applications sometime ahead of planting, if possible, and mix the ashes uniformly and thoroughly with the surface soil. Smaller quantities may be applied to the hills, plants, or trees, but always scatter the ashes well and evenly over the whole area that is supposed to cover the roots.

My remarks of the greater influence of quantity over mode of application should not be misconstrued. I do not wish to convey the idea that it is of little consequence how ashes and other fertilizers are put on the land if they only get there. Not so. The careless dumping of a pail of strong ashes next to the body of a young tree, or of a shovelful upon a strawberry plant, would do more harm than good. But it seems like a waste of words to talk about it; for no intelligent soil-tiller would be guilty of any such folly as to apply wood ashes *in heaps* over

his land. Common sense should teach us all that the only right way of applying strong fertilizers is by an even distribution all over the soil. You may sow them by hand, or, better, by means of fertilizer spreaders. Your chances of best results are usually increased if the application is made in the fall, and the land plowed immediately. In the spring the field can be plowed again, perhaps an inch or so deeper, and the ashes again brought near the surface. But, after all, it will make very little difference how you mix the ashes with the soil if you only do it, and do it thoroughly. The plant roots will be able to find the potash, and phosphoric acid, and lime, etc. Usually I make my applications (in the garden) on the surface after plowing, and then harrow, or cultivate and harrow, the land thoroughly until fine and smooth.

Even Distribution.

VI.

SPECIAL DIRECTIONS.

A. FARM CROPS.

Clover.—One to two tons per acre as a first application; smaller dressings annually afterwards. Fall application preferred.

Meadows.—Same as clover.

Pastures.—Same as clover. The addition of 100 pounds of bone meal is often advisable.

Lawns.—Two to three tons per acre for a first application; 500 pounds annually afterwards. Spread on evenly in fall, winter, or early spring. If there are uneven spots, brush the

ashes apart where too thick with a broom. In some cases the smoothing harrow may be run over the lawn, especially if old, after the ashes and a little new lawn seed are put on.

Wheat.—One to two tons to the acre, applied broadcast and harrowed in. One point should be borne in mind, that it is almost impossible to apply too much ashes for grain, especially when seeding down. If the ground is to be seeded to clover, the regular clover application (a ton or two of wood ashes per acre) might as well be made at the same time, or even before drilling in the seed and wheat fertilizer.

Rye.—Same as wheat.

Oats and Barley.—Same as wheat, applying it either in fall and replowing in spring, or at the time of sowing the seed in early spring.

Corn.—One to two tons, either all broadcast, or part broadcast and part in the hill. Apply before planting, and mix well with the soil. Sometimes a little bone meal (100 pounds or more to the acre) goes well with it.

Potatoes.—Use same quantities and methods of application as recommended for corn. Feed the preceding clover crop heavily with wood ashes, and then feed the second growth clover to the following corn and potato crops. Or you can apply one to two tons of ashes to the land in the fall, plow before freezing, replow in spring, and plant.

Sweet Potatoes.—One to two tons per acre. Always apply all the fertilizers to the hills for this crop, but mix them well with the soil.

Peas and Beans.—From 500 pounds to two tons per acre, broadcast after plowing.

Cotton.—One to three tons per acre. Apply broadcast in fall, winter, or early spring.

Hops.—When starting a new yard, mix a pound or two thoroughly with the soil in each hill, and also apply 500 to 1,200 pounds per acre broadcast. Increase the annual dressings as the vines grow older, using at least eight or ten pounds to the plant.

B. VEGETABLE CROPS.

Onions.—Two to four tons per acre, preferably broadcast in autumn. Plow just before freezing; replow in spring and prepare for planting. On muck lands plow land in autumn, spread ashes broadcast, and fit ground by cultivating and harrowing in spring. For second year one ton per acre will be sufficient.

Cabbage and Cauliflower.—Two to three tons per acre. Apply broadcast in fall or very early in spring. About half a pint may be scattered on the ground around each plant soon after setting. I invariably use a few hundred pounds of nitrate of soda per acre with best results.

Root Crops.—For beets, carrots, parsnips, radishes, etc., use from one to three tons in the fall; plow in spring and apply another ton. Harrow and sow.

Celery.—One to three tons per acre. Plow in before planting. Top dressings may be given afterwards.

Tomatoes.—One to two tons per acre, with a few hundred pounds of bone meal. Apply after plowing, then harrow and set the plants. Afterwards scatter a small quantity around each plant.

Vines.—For cucumbers, melons, and squash, use in place of one-half of the usual heavy applications of compost from one to two tons of wood ashes per acre. Work the ashes well into the soil before planting the seed. Hill applications may also be made afterwards.

C. FRUIT CROPS.

Peaches.—Apply one and a half to two tons per acre when preparing soil for planting orchard. Around young trees just set out apply two or three pounds of ashes, and work it well into the soil. Increase the quantity at each annual dressing, at first adding about two pounds per tree each year, and three or four pounds when the trees have come into bearing. Broadcast application of say two tons or more per acre when the trees are of bearing age will be entirely safe, and usually most convenient.

Apples.—Same as peaches.

Pears.—Same as peaches.

Quinces.—Same as peaches.

Cherries.—Same as peaches. Smaller applications may suffice.

Plums.—Same as cherries.

Grapes.—Same as hops (under *A*).

Currants.—Two tons of the ashes per acre. Apply in fall or spring. Or two to three pounds worked into the soil around each plant.

Gooseberries.—Same as currants.

Raspberries.—Two or three pounds of the ashes to the bush, well worked into the soil; or two tons per acre applied broadcast in fall or early spring.

Blackberries.—Same as raspberries.

Strawberries.—One to three tons of the ashes per acre. Use a ton or two broadcast after the ground is plowed for a new plantation. Use the harrow freely afterwards. A top dressing of a ton or two may be given later. The crop is a valuable one and will pay well for extra manuring.

VII.

SOME PARTING WORDS

FROM THE PUBLISHERS.

Probably you are in need of unleached wood ashes. We are in the business of collecting and supplying them. We know there is a great difference in the value and quality of ashes, and it requires good judgment and long experience to be able to secure good ashes all the time.

An experience of over twenty years has enabled us to acquire that knowledge. Our ashes are gathered from house to house, giving employment to several hundred men and horses, and housed as gathered. We also do our own shipping, and are therefore able to say that our ashes are the best in the market. Many have attempted to supply unleached ashes but from their want of experience as to quality, their ashes have not given the satisfaction which had been promised. With us our trade in unleached ashes has constantly increased from the first year's shipment of 30 tons until now our shipments amount to several thousand tons each year. We give it our personal and exclusive attention, so that we can most certainly guarantee our wood ashes to be the best and cheapest fertilizer in use. As we make the fertilizer trade our business, it is for our interest to sell only the best that can be obtained, thereby enabling us to increase our trade. Those who have made the most thorough tests in the use of our Canada unleached ashes, assert that they are superior to the best of stable manure for all kinds of fruit and fruit trees, grass and other crops. They also produce a steady and permanent improvement of the soil.

We would be pleased to have you examine the analyses of our

Canada unleached hardwood ashes, found upon the following pages. They have been made by some of the best chemists in Massachusetts and other States, some of whom are in charge of agricultural experimental stations of those States. From such analyses it will be seen that our unleached ashes contain from 5½ to 8½ per cent of potassium of oxide, or pure potash, equal to from 8 to 12 per cent of carbonate potash, which is the most valuable of all potash for agricultural purposes, especially for all fruits and fruit trees.

Potash as found naturally in wood ashes is in the form of carbonate. Chemists in analyzing ashes reduce this potash to what they style potassium oxide, which is not always distinctly understood and needs a little explanation. Thus, suppose a chemist in an analysis of wood ashes makes the potassium oxide 6 per cent; this would be almost nine pounds of carbonate potash contained in 100 pounds of wood ashes. No careful test that has been made of our ashes places the potassium oxide below 5 per cent. Entire satisfaction has been expressed by all who have given our ashes the most thorough tests, both with the quality and price, and more particularly after a few years use, when they find their returns plainly visible in the early ripening of their grain or the lusciousness of their fruit. Some have gone so far as to say they really derive more benefit from a ton of ashes than from a like quantity of mercantile fertilizer costing more than double what the ashes do. State ashes have been sold in some sections at from 45 to 60 cents per bushel, or equal to about $25 to $30 per ton, and the consumers have even at this price found them very profitable for all vegetables and fruit trees.

The name "wood ashes" is not always a guarantee of the value contained in the article, for there is as much difference in the quality and value of ashes as there is in tea, coffee, sugar, or any other article of food or merchandise.

VIII.

APPENDIX OF ODDS AND ENDS.

BY THE PUBLISHERS.

ANALYSES OF UNLEACHED AND LEACHED ASHES.

We give below the average analyses of 19 samples of unleached ashes and of 13 samples of leached ashes made at the Connecticut Agricultural Experiment Station, which can be found in "Appleton's Farmers' Annual Hand-Book," as follows:

	UNLEACHED ASHES.	LEACHED ASHES.
Moisture	6.7	30.9
Silica and insoluble	13.7	11.7
Alumina and oxide of iron	2.8	2.1
Lime	30 9	29.7
Magnesia	4 9	3.0
Potash (pure)	7.7 eq. to C. P. 11.317	1.1 eq. to C. P. 1.617
Soda	1.0	0.4
Sulphuric acid	1.4	0.1
Phosphoric acid	2.1	1.5
Chlorine	0.6	0.1
Carbonic acid	23.2	21.1

It will be seen from the above analyses that leached ashes contain only one-seventh as much potash as unleached ashes, although they are sometimes sold at from 18 to 24 cents per bushel, and are considered valuable as a fertilizer even at that price, thus proving the great value of the large quantity of vegetable lime which the Canada ashes contain; yet the unleached ashes, containing, as they do, seven times as much potash as the leached ashes, and very much richer in phosphoric acid, magnesia, sulphuric acid and soda, renders the unleached ashes more than three times as valuable as the leached ashes.

The following analyses are taken from the thirteenth annual report of the State Board of Agriculture of Massachusetts, which gives the analysis of two samples of unleached ashes from different parts of that State, and by comparing them with the analysis of our Canada unleached ashes, at once shows the great difference between State and Canada ashes in potash, lime, insoluble matter, and consequently in value:

	1.	2.
Moisture	1.78 per cent	2.26 per cent
Potassium oxide (potash)	2.90 "	3.26 "
Sodium oxide	not determined	1.83 "
Calcium oxide (lime)	4.84 per cent	20.29 "
Magnesium oxide	3.15 "	not determined
Phosphoric acid	1.55 "	1.28 per cent
Insoluble matter	63.93 "	35.15 "

We give below the analyses of two samples of our ashes made by Prof. George H. Cook, of New Brunswick, N. J., which can be found in the New Jersey State report:

	1.	2.
Pure potash	8.72	5.87
Phosphoric acid	1.17	2.02
Lime	36.80	42.60

The following analyses of our ashes are taken from the annual report of the State Agricultural Experiment Station at Amherst, Mass., by Prof. C. A. Goessman:

	1.	2.	3.	4.
Moisture	16.70	8.33	1.03	10.01
Calcium oxide (lime)	35.26	45.00	50.02	35.67
Potassium oxide (pure potash)	5.55	5.91	6.94	7.19
Phosphoric acid	2.28	1.74	1.29	1.28
Insoluble matter	4.90	3.88	2.28	6.37

	FROM BULLETINS NOS. 11 AND 13.	
Moisture	5.56	15.00
Calcium oxide (lime)	35.68	35.22
Potassium oxide (pure potash)	5.83	5.50
Magnesium oxide	0.61	3.24
Phosphoric acid	2.55	2.53
Insoluble matter	11.95	9.05

To RICHARD WEBSTER, Haverhill, Mass.:

The wood ashes received from you, said to be Canada ashes, contain:

Potash (K. O.)	5.42
Phosphoric acid (P. O.)	1.53
Lime (Ca. O.)	35.40
Iron and alumina	.92
Carbon and carbonic acid	32.78
Moisture	13.01
Magnesia (Mg. O.)	2.65
Silica	8.29—100.00

These ashes are evidently pure, unadulterated wood ashes. They have, however, absorbed considerable moisture and carbonic acid from exposure to the air. Their market value would be about as follows:

5.42 lbs. of potash at 10c	.5420	
35.40 lbs. of lime at 1¼c	.4375	
1.53 lbs. phosphoric acid at 10c	.1530	—.7835
Value per bushel		39 17-100

If these ashes were perfectly dry they would be worth 45 cents per bushel at the market rates for potash, phosphoric acid and lime. Crude potash is worth 5 cents per pound. This only contains about 60 per cent of pure potash (K. O.), so that the price of potash in this form is 8½ cents per pound. The carbon or charcoal in wood ashes also adds to their value as a fertilizer. The potash in the wood ashes is of considerable more value than when it exists as a chloride or sulphate, as in the German potash salts. Respectfully,

S. P. SHARPLES, *State Assayer,*
Boston, Mass.

One of the more recent analyses of our unleached wood ashes, made by Prof. H. J. Wheeler, of the Rhode Island State Experiment Station, is here submitted:

KINGSTON, R. I., July 21, 1894.

Munroe, Lalor & Co., 32 Arcade Block, Oswego, N. Y.

GENTLEMEN:—The following is the result of analysis of sample of ashes collected April 9, 1894:

Phosphoric acid	1.62 per cent.
Potash (potassium oxide)	6.09 "

Very truly, H. J. WHEELER, *Chemist.*

We give below the analysis which represents the average of 15 samples of our Canada unleached wood ashes taken from that number of cars while they were being unloaded at destination and analyzed by Prof. George Archbold, Phœnix, N. Y. Their value is calculated at the market price for each constituent.

	ELEMENTS FOUND IN 100 LBS. OF ASHES.			VALUE PER TON.
Moisture	6.865			
Potassium oxide, 8.276, equal to carbonate potash, ($K^2.C.O^3.$)	12.249	at 5c.	per lb.	$12.15
Phosphoric acid ($P^2.O^5.$)	2.408	" 15c.	"	7.22
Calcium oxide (vegetable lime) (Ca. O.)	35.394	" 1¼c.	"	8.85
Magnesium oxide (Mg. O.)	4.486	" 4c.	"	3.58
Oxide of Iron ($Fe^2.O^3.$)	1.896	" 1c.	"	38
Sulphuric acid ($S.O^3.$)	1.100	" 3c.	"	66
Chlorine (Cl.)	0.560	" 5c.	"	56
Silica and alumina ($Si.O^2.$ and $Al^2.O^3.$)	5.415	Not calculated, but of great value to the soil and plant.		
Carbon (charcoal)	8.620			
Carbonic acid ($C.O^2.$)	24.980			

Which makes the commercial value per ton of 2,000 pounds.....$33.40

Their agricultural value proves to be very much above these figures by those who have had several years experience in the use of unleached wood ashes and also with commercial fertilizers. The declaration is frequently made that more benefit is derived from the use of a ton of good unleached wood ashes, from the time of their application and while they continue to exhibit their usefulness in the soil (lasting, as they do, many years), than is derived from an equal quantity of commercial fertilizer, costing from $35 to $50 per ton.

Unleached wood ashes are really nature's complete fertilizer. The elements of which they are composed, being drawn from the soil, are in just the condition required for the growth of the plant.

The chemical action of unleached ashes, after being applied to the soil, draws from the atmosphere all the nitrogen required to supply the plant during its growth and ripening process.

Prof. C. A. Goessman, Amherst, Mass., says in his report

on ashes: "The universal high opinion of wood ashes as a fertilizer does not depend merely upon a fair percentage of potash, but also on the presence of more or less of all the various mineral elements essential to the growth of plants. Wood ashes, like barnyard manure, on account of their compound character, meet, to some extent at least, not only known but unknown deficiencies in valuable soil constituents. The thorough mixture of the various constituents have, no doubt, a beneficial influence on their action."

Much is said regarding the value of artificial manure containing a large per cent of available phosphoric acid ($P_2.O^5$.) However, it is now an admitted fact that the most of it is again rendered insoluble and useless as plant food after mixing with the soil. On this point Lawes and Gilbert, speaking of the constituents of artificial manure, say: "There can be little doubt that some of them, especially phosphoric acid, assume more or less insoluble forms after mixing with the soil, and cease to be available as food for the plant." The phosphoric acid in wood ashes is in the form of phosphate of lime, equal to bone phosphate ($Ca_3.P_2.O^8$.), and is in the best possible form in wood ashes, and held soluble by them for delivery to the growing plant. It is now an undisputed fact that wood ashes are capable of producing a marked and long effect on succeeding crops. The value, therefore, of pure unleached wood ashes in agriculture cannot be overestimated, inasmuch as their constituents are those really used in the proportion required by nature.

The general analysis of wood ashes shows that there is from 42 to 48 per cent of magnesia, soda, sulphuric acid, silica, carbonic acid, alumina and oxide of iron. While these elements are not considered of any particular importance by the chemist, they are of great value to the soil, crops and fruit. Many soils are deficient in these constituents in available forms. When articles of an apparently similar character are offered to farm-

ers for their consideration, it is necessary for them to understand the chemical condition of the various fertilizing materials, both simple and compound. Their degree of fineness, thorough mixture of all constituents, their solubility, their power of rapid diffusion through the soil—these are the conditions which should be taken into consideration when determining the real value of a fertilizer, and which we claim are found only in wood ashes, containing, as they do, all the constituents found in new soil in better proportions and more thoroughly mixed than in any other fertilizer.

J. J. H. Gregory, the great seedsman of Marblehead, Mass., addressing the market gardeners at a meeting of farmers, in alluding to the use of potash for fertilizing purposes, said: "If you want something in your fertilizer besides potash, that is an argument for ashes. The potash in German salt is a dead potash. The potash in ashes is a caustic, biting potash. It will cut into the soil and make it more digestible and better suited for plant food. It is an active agency in collecting plant food from whatever it comes in contact with. The German potash does not do this. The latter has quite a proportion of salt. Considering that wood ashes contain an active potash, and so many other elements besides potash, and the proportions which are perfect for plant food, except nitrogen—for the Creator made them so—I oftentimes prefer wood ashes. In regard to the application of potash to the crop, here is a general fact: To get the best results we want to apply them before the dry season comes on, when frost and rain and snow will have plenty of action upon them, diluting and disseminating them through the ground. The best way to apply potash is in the form of ashes."

When potash is applied in any other form than in ashes there is danger of its leaching out too rapidly and being lost. Potash in unleached ashes is in the carbonate potash form, and in this form is held in store by the ashes and leaches out gradually;

the potash is absorbed by the soil and the danger of loss by too rapid leaching avoided. We claim that the condition in which carbonate potash is found in wood ashes renders it as a fertilizer for agricultural purposes of equal value, pound for pound, as potassium oxide.

If in 100 pounds of ashes there are found seven pounds of potassium oxide, it is equivalent to 10.29 pounds of carbonate potash, the price of which in the market would be five cents a pound. At this estimate it will readily be seen that the value of the carbonate potash in one ton of wood ashes would be $10.29.

The phosphoric acid in ashes being in the form of phosphate of lime, and equal to bone phosphate ($Ca^3.P^2.O^8.$), its value is at least 15 cents per pound at destination. It readily becomes soluble again upon being applied to the soil, and its action upon the plant when applied in this form produces the best possible results. The vegetable lime in ashes being very fine, and five times as strong as stone lime, and prepared by nature for the soil and plant, easily becomes soluble again, and its value is at least 1¼ cents per pound. According to these figures, allowing the average to be only 7 per cent of potash, 2 per cent of phosphoric acid and 39 per cent of lime, it will be seen that our ashes are worth at destination $26.25 per ton for those ingredients alone, and when to these are added the silica, iron, magnesia and carbonic acid, their value must certainly be estimated at from $30 to $35 per ton, and their use upon the crops will show their value to be even above these figures.

The prices generally given in reports from experimental stations, touching the value of different fertilizing elements, are based upon the wholesale price at certain centrally located points, and to these should be added 20 per cent for railroad freights and other expenses to destination before the consumer will receive the goods. Our unleached wood ashes are delivered at the nearest railroad station to the purchaser at the prices named by us for the ashes.

ANALYSES OF FARM PRODUCTS.

The following analyses show the quantity of the elements which are taken from the soil and atmosphere by the average crops as here given. It will readily be seen that our unleached wood ashes contain and furnish to the soil all the elements required in the cultivation of these several crops :

Elements taken from Soil and Atmosphere by	Potash.	Phosphoric Acid.	Lime.	Sulphuric Acid.	Ammonia.	Magnesia.	Silica.	Oxide of Iron.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Potatoes—One hundred bushels and tops	179	52	60	29	22½	19	43	....
Tobacco—One ton, leaf and stem, as grown	147	17	178	19	22	50	46	....
Cotton—One ton fibre, seed and stalk	154	60	71	16	20	44	15	....
Corn—One hundred bushels, ears and stalks	180	79	48	23	81	35	168	....
Wheat—Twenty-five bushels wheat and straw to the acre	36	27	14	7	52	20	145	....
Rye—Thirty bushels rye and straw per acre	33	22	14	21	43	7	98	....
Oats—Fifty bushels oats and straw per acre	14	16	10	10	45	8	48	....
Barley—Thirty bushels barley and straw per acre	33	15	10	7	41	6	77	....
Clover Hay—One ton	40	10	38	4	26	11	10	....
Turnips—Twenty tons per acre	140	43	90	50	42	14	53	....
Carrots—Twenty tons per acre	134	39	197	37	48	29	60	....
Peach Tree—One ton wood	26	4	54	6	....	7	5	2
One ton fruit	74	12	2	5	....	6	20	1

STABLE MANURE.

The American Agriculturist of a recent date says: At a meeting of the New York Farmers' Club, Mr. Charles V. Mapes presented an able paper upon fertilizers, and in alluding to stable manure gave its composition as follows: "In 2,000 pounds well rotted average stable manure we have:

Water	1,400 to 1,500 pounds.
Vegetable organic matter	350 " 400 "
Ash	150 " 170 "

"Its ash contains lime, soda, magnesia, salt, etc. Of really valuable ingredients, the ton contains less than 30 pounds, viz.:

Nitrogen	10 to 12 pounds.
Phosphoric acid	6 " 7 "
Potash	10 " 12 "

"The nitrogen is included in the ammonia, 17 pounds of which contain 14 pounds of nitrogen. These 30 pounds or less of available constituents per ton vary greatly in their solubility and practical value, according to the crop to which the manure is applied. On one hand, corn, rye, and clover, with their strong, far-reaching root growth and rank feeding powers, can utilize a considerable portion during their first season. On the other hand, light and dainty feeding crops with limited root growth, such as onions, potatoes, oats, strawberries, hops, and even wheat and barley, with comparatively short seasons of growth, and requiring large and available supplies of plant food within easy reach, cannot utilize these 30 pounds of farm manure.

"Corn will thrive with moderate dressings of quite coarse stable manure, but the onion crop is so dependent upon liberal quantities of thoroughly decomposed and, as may be said, ready food, that we find onion growers taking two or three years to prepare lands which are even naturally adapted to this crop. They apply large quantities of good stable manure each year in excess of the annual requirements, to lay up the necessary stores for the dainty onion."

HOW UNLEACHED ASHES MAY BE TESTED.

There are two or three simple ways in which the strength of potash and ashes may be tested:

First. By putting a few upon the tongue to dissolve, and repeating the experiment two or three times.

Secondly. By wetting a few in the hand and washing the hands with them, and the potash will exhibit itself by the hands becoming very slippery, as though washed with soap.

Thirdly. If the ashes have stood some time where they have become air-slacked and tasteless, then they can be tested by putting say three tablespoonfuls of the ashes in a third of a tumbler of warm water and letting them stand over night; then taste of the liquor. The better way, of course, is a chemical analysis, but this is not always convenient.

If it is desirable to make a further test, the following plan can be adopted: Take a tight barrel; make a hole near the bottom, to which fit a plug; in the bottom put a few small sticks of wood crossways, and a little straw on top of the wood; pack the barrel full of ashes, using about 200 pounds, and leaving a slight hollow in the center; fill with water, letting it cover the top of the ashes; let stand a day or two to get out the strength of the potash. When the lye is required for making soap or other purposes, all that it is necessary to do is to pull the plug and let it drain off. If required for chemical or domestic uses, it should be sufficiently strong to bear up an egg. If this lye is boiled down into potash about 12 to 15 pounds will be obtained, or, as is frequently the case, it can be utilized for making soft soap by putting about 20 gallons of the lye into a kettle; add about 15 pounds of grease, and boil together until the grease is dissolved. After drawing off the first lot of lye as above, then plug up the hole in the barrel, put on more water, and again draw off the lye and add to that in the kettle about 15 gallons.

If the lye is still too strong to come to soap, add a few gallons more of water, and use more of the weak lye. The result will be from 40 to 45 gallons of the most splendid soft soap.

This second run of lye is worked into the soap in thinning, and it may need more weak lye afterwards to make it sufficiently thin for practical use.

CAUTION.

Care should be used in handling unleached ashes, as they are strong in potash, and will burn clothes or take skin off the hands if handled without gloves in warm weather.

WHAT OTHERS SAY ABOUT OUR ASHES.

The letter given below was written some time since by a gentleman connected with one of the leading agricultural schools of the country:

To the Editor of The Country Gentleman:—I would like to say to your correspondent who inquires about Canadian ashes, that last spring we used a carload of them, bought from a dealer in Oswego, N. Y. They were bought by a sample which we analyzed in our own laboratory, and with which carload was to agree. Our chemists, whose analysis I have now on hand, reported that they would be cheap enough at the price, $16 per ton delivered at our station. The carload averaged rather better than the sample. We used these ashes with the best results on Irish and sweet potatoes, our crop of Irish potatoes being exceptionally fine. The ashes were so strong that in spreading them on plowed land they took the hair off the ankles of the mules hauling the wagon. I expect to use them largely the coming season, as I consider them the cheapest commercial fertilizer that I can buy for certain vegetables and fruits. I expect to try them also as a top dressing on grass land, having been pleased with a small trial on a lawn last spring.

W. F. MASSEY.

Miller Manual Labor School.

A leading tobacco raiser in the Connecticut Valley, Mr. Francis Clapp, says:

For the past seven years I have used your Canada unleached hardwood ashes as a fertilizer in growing tobacco with great satisfaction. The yield is largely increased and quality greatly improved by their use. I have used side by side with these ashes stable manure and patent fertilizer, and found the ashes beat them all. The leaf is very large, smooth and silky, drying a nice color, burning well, leaving a white ash, and brings the highest price in the market.

In using ashes for tobacco, where no ashes have been used before it is well the first year to use a little nitrate of soda or sulphate of ammonia around the plant when first set out to help start it until the ashes get to work; then they will carry it through, making an early growth.

Wood ashes also restore to old, worn soil lost elements that have been taken from it by the continual cropping with tobacco. Some of my soil had become so run out that it did not matter how much manure I put on, it would not grow over 1,000 to 1,200 lbs. of tobacco, while now, by the use of ashes, I can grow as large and as nice crops as ever, even as high as 2,000 lbs.

Mr. Powell, director of farmers' institutes and president of New York State Agricultural Society, writes:

ALBANY, N. Y., March 9, 1893.

My Dear Sir:—Yours duly received. I have decided to have you forward me a carload of ashes to Ghent, N.Y., which is on the Hudson branch of the Boston & Albany Railway. If they are equal to the others which I had from you, they must show a very high analysis, as I never had such good ashes as the ones you sent me. I will take photos of currants, gooseberries, grapes, cherries, apples, grain and grass, and give a full line of experiments that will be of interest and value to the public.

Yours very truly,

GEO. T. POWELL.

POCANTICO HILLS, August 21, 1893.

Gentlemen:—I have used your ashes on three separate orders in past years, and have found them more useful and beneficial on my lands than any other manure I have applied. In one instance the results were so surprising as to attract the attention and curiosity of many persons, producing upon a rough hillside no less than seven successive crops of the finest clover ever grown in this vicinity, as the same was pronounced by an intelligent and experienced farmer, who has resided here more than fifty years.

Experience on other lands, though not so surprisingly successful, enables me to say that my use of your ashes has satisfied me that on our hills they are the cheapest and best of manures.

I am, very respectfully,

NOAH DAVIS.

The writer of the above, Judge Davis, is well known throughout the Eastern States.

A prominent Massachusetts farmer, Mr. E. W. Jackson, who grows large quantities of onions, writes as follows:

During the past six years, except for the past season, I have been using your Canada hardwood ashes and commercial fertilizer on my onion land, using one hundred bushels of ashes and one ton of fertilizer per acre, with excellent results.

The past season I used commercial fertilizer without the ashes and did not get one-half the yield that I did when I used ashes. I had a large growth of tops, but the onions bottomed very poorly.

In the future I shall use ashes for growing onions, if I can get them, for I think they are the best fertilizer that I can use for that purpose.

The following appeared recently in the columns of that standard publication, *The Country Gentleman:*

Editor Country Gentleman:—Referring to article on page 410, let me say that there is no source of potash equal to wood ashes, and when an average good sample of the unleached article, dry, can be had at $12 or less a ton, it is also a cheap potash manure. A ton should contain from 110 to 140 lbs. of potash (potassium oxide, $K^2.O.$) in the best form, that of carbonate, in which potash could be applied. This potash is worth five cents and possibly six cents a pound. It is in good shape for plant food. Then ashes have considerable value as a moisture preserver, and may be used as a means of preventing injury from drought. Ashes also contain 1½ per cent of phosphoric acid, and the lime which they contain also counts for something. Altogether, I have a high idea of wood ashes as a fertilizer for fruit and garden crops.

"Minisink," however, tells us that we can buy 1,900 lbs. of potash, as sulphate of potash, which is frequently 95 per cent pure potash, at less than $50, and 1,600 lbs. of pure potash, as muriate of potash, at $40 or $45. I should be glad of a chance to purchase pure potash at such rates. Now let us see where "Minisink" makes his mistake. There are samples of sulphate of potash which contain 95 per cent not of "pure potash" (potassium oxide, $K^2.O.$), but of pure sulphate of potash ($K^2.SO^4.$), which is an altogether different thing. A little over half of this 95 per cent pure sulphate of potash represents the amount of pure potash (potassium oxide), so that the best samples of the commercial, high-grade sulphates have about 50 per cent of potash. This, at five cents a pound, would make the article worth about $50 per ton. I think we used to pay about $60 a ton for it. But it is a safe manure to apply to all crops that need potash, which cannot be said of muriate of potash. This I would not recommend for potatoes, nor for tobacco, nor for many of the fine garden vegetables. Muriate of potash is usually about 80 per cent pure muriate (chloride) of potash, not 80 per cent pure potash (oxide), and consequently contains from 40 to 50 per cent of pure potash. It costs about $45 per ton.

"Minisink's" figures, therefore, dwindle down from 1,900 lbs. of pure potash for the sulphate of potash, and from 1,600 lbs. for the muriate of potash, to 1,000 lbs. or less in both cases. This makes a material difference as to the cost of the pure potash. When I can get good dry unleached hardwood ashes, let me tell you I will not spend much money for any of the products of the Stassfurt mines unless I use kainit as an ammonia-fixer in the stables.

(Signed) T. GREINER.

Niagara County, N. Y.

A TEST WITH ASHES TO GROW IRISH POTATOES.

The Ohio Agricultural Experimental Station tested the following fertilizers on this crop with the following results:

Fertilizers used were hardwood ashes, coal ashes, lime, gypsum, salt, hen manure, a mixture of ashes and plaster, also one of ashes and lime. They were applied when the potatoes were about two inches high. The hardwood ashes gave the best increase over the natural yield of the land. Ashes and plaster gave about the same result, while plaster alone gave no effects; neither did the lime. Salt should be used with caution, not over five bushels to the acre. Coal ashes had a marked beneficial effect. Hen manure gave excellent results, appearing to be about the same as wood ashes.

BONE FERTILIZERS.

In order to meet the demand for bone meal and other bone fertilizers, which it is so often desirable or even necessary for best results to apply with wood ashes, we have taken the general eastern agency for the

PURE ANIMAL FERTILIZERS

manufactured by the famous firm of Armour & Co., of Chicago, Ill. We offer these goods to our customers at lowest possible rates. All these fertilizers contain nothing but pure animal matter, collected, steamed and boiled at the company's great packing-house. We offer the following brands:

1. BONE MEAL.

OHIO OFFICIAL ANALYSIS FOR 1893.

Ammonia	3.10	per cent.
Total phosphoric acid	28.28	"
Phosphoric acid, fine bone	21.49	"
" " medium bone	6.79	"

Commercial value per ton, $37.77.

2. BONE AND BLOOD.

OHIO OFFICIAL ANALYSIS FOR 1893.

Ammonia	8.25	per cent.
Total phosphoric acid	10.09	"
Insoluble " " medium bone	4.53	"
Available " " fine bone	5.56	"

Commercial value per ton, $40.84.

3. QUICK-ACTING BONE.

OHIO OFFICIAL ANALYSIS FOR 1893.

Ammonia	3.00	per cent.
Total phosphoric acid	21.30	"
Insoluble " " medium bone	11.44	"
Available " " fine bone	9.86	"

Commercial value per ton, $34.44.

4. DISSOLVED BONE.

OHIO OFFICIAL ANALYSIS FOR 1893.

Ammonia	2.20	per cent.
Total phosphoric acid	15.48	"
Insoluble " "	4.99	"
Available " "	10.49	"
Potash	.09	"

Commercial value per ton, $25.55.

Prices and other information given on application.

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