

Application of Chemistry and Geology to Agriculture.

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(Continued from August issue.)

CARBON—ITS PROPERTIES AND RELATIONS TO VEGETABLE LIFE.

Carbon is the name given by chemists to the substance of wood charcoal in its purest form. It is from the Latin word Carbo coal. When wood is distilled in close vessels, or burned in heaps covered over so as to prevent free circulation of air, wood charcoal is left behind. When this process is well performed the charcoal consists of carbon with a small admixture of earthy saline matters commonly known as the ash when the charcoal is burned in the air.

Charcoal burned in the air produced little flame and with the exceptions of the ash entirely disappears. This flame produces a kind of air known among chemists as carbonic acid, which ascends and mingles with the atmosphere. Charcoal is very light and porous and easily floats upon water, but plumbago or black lead and the diamond, which are only other forms of carbon are heavy and dense, the former is 2½ and the latter 3½ times heavier than water. The diamond is the purest form of color and with a great heat it burns in the air or in oxygen gas, and like charcoal disappears in the form of carbonic acid gas.

Carbon forms a very large proportion of the substance of vegetable matter when it is free from water, amounting to from 40 to 50 per cent., by weight, of all the parts of plants which are cultivated for the food of animals or man, that is, in their dried state. Therefore in nature it will be seen that it performs a very important part, and becomes an important study for the farmer.

The perfect insolubility of charcoal disproves the common idea that it can be used as a fertilizer or as plant food in any manner, but its actions with other substances does give it an indirect agency in this way. It resists the action of the air as well as of the moisture, hence it is almost indestructible; it has the power of absorbing in large quantities into its pores, the gaseous substances and vapors which exist in the atmosphere. Thus of ammonia it absorbs ninety-five times its own bulk of sulphuric hydrogen, fifty-five times of oxygen, nine times of hydrogen, nearly twice its bulk, all of which are of the greatest importance in forming plant food, and on this property the use of charcoal powder as a manure probably in some measure depends. It also separates from water any decayed animal matter which it may hold in solution, hence it forms a very important part in purifying its surroundings. The action of charcoal can readily be seen upon plants by the dark green color of the herbage and the luxuriance of its growth. It has as much as one hundred square feet of surface in its exceedingly fine pores in every cubic inch. It also has the property of absorbing disagreeable odors in a very remarkable manner. Hence animal food keeps longer sweet when placed in or near charcoal. In cellars where potatoes and other vegetables are kept it has a powerful influence in keeping everything sweet and healthy. If thrown in closets it will deprive night-soil of its disagreeable odor and to convert it into a dry and portable manure. The half carbonized roots of grasses which have long been subjected to irrigation acts on the impure water by which they are irrigated, and this

gradually arrest and collect materials which go to make up plant food for the coming crop.

It changes ammonia into nitric acid, and this serves a most useful purpose as an ingredient of manure heaps and deposits, preventing its loss. Humus is another form of carbon though an impure one. It is the decomposed remains of vegetable matter which has undergone the slow process of decay. It exists in swamps in form of peat and black porous soil. The leaf mold so beneficial as plant food is chiefly humus. It contains various acids of geic, ulmic, and nitmic acids. This class of substances is of great importance in agriculture, as by their decomposition they give up carbonic acid to plants, which is the greatest ingredient of plant food.

The Dairy.

Testing of Milk.

I see from Hoard's Dairyman there is no subject connected with farming which is receiving so much attention by scientists at experimental institutions and by leading dairymen in the United States as this question of testing milk. The testing of milk is becoming a necessity to determine the value of individual cows milk for the farmers benefit, and also for the determining of the value of different herds of cows milk which is sent to factories and creameries to be manufactured into cheese and butter, as the case may be. There has been good progress made in this direction during the past three years, but there is still much to learn about the cow—her breeding, feeding and produce.

The first simple instrument in use is the Heeren's pioscope, which gives six different shades of color for the same number of different qualities of milk, which gives a fair idea for comparing one quality of milk with another.

The centre of the block is hollow and a few drops of milk is put into it when the shaded glass is put over it, which always gives the same depth of milk, and the shade of cream is a bright, light, solid like color; each shade is darker as the milk is poorer, till very poor milk is a thin dark blue as the block

is a dark ground on which the milk in the centre is shown. Whatever shade of color the milk is that agrees or corresponds with the shade of color on the glass; that gives the quality and character of the milk in the centre of the block; it gives no value to the constituents in the milk, but shows whether the milk is normal.

The next instrument is the lactometer. This instrument is used the same as a densometer, which gives the specific gravity of the milk compared with the weight of an equal volume of water. The starting point to determine a fixed unit in order to make comparisons is one cubic inch of distilled water at 4° centigrade of temperature or about 39° Fahrenheit, put thus, 1,000. The specific gravity of liquids is found by comparison with this unit, thus the specific gravity of pure milk is 1,030 to 1,032, thus it is heavier than water. The lactometer is figured thus, pure cold water at 60° Fahrenheit is 0. Pure milk, which carries the lactometer higher at the same temperature, is marked at 100. The distance on the

spindle of the lactometer, between pure water

and pure milk at the same temperature, is divided into 100 parts or degrees, and by this instrument the specific gravity of the milk is ascertained. Whether it carries the instrument at 100, or if water is added the specific gravity will be reduced and the instrument will sink deeper according to the quantity of water which has been added and thereby shows what percentage of water has been added to the milk; or if milk has had strippings of the cows kept out or cream taken off it will have the opposite effect of water.

The lactoscope is an instrument which shows the quantity of milk by the amount of butter fat which the milk contains. This is a glass cylinder. In the centre at the bottom is a small porcelain column with black lines drawn across; 4 c. of milk is measured by a pipet and put into the cylinder and water added till the black lines are visible through the milk. The figures on the side of the cylinder give the percentage of butter fat in the milk. This instrument may not give exactly the percentage of fat in some individual cows, but for testing the milk of herds of cows as the milk is sent to cheese factories, for the purpose of detecting adulteration, it is the best known instrument at present,

and for all practical purposes in testing milk for the above purpose is perfectly reliable and satisfactory. Nothing short of a complete analysis can give the various constituents of milk correctly and in detail, but that is impracticable for factories at present and would be too expensive, but the time is not far distant when some means will be found by which milk will be analysed in a speedy and cheap manner which will not be disputed. If these three instruments all agree as to the character of the milk tested they are pretty correct in determining the character and quality of the milk.

At the Dairymen's Association, held in Stratford last January, this subject was fully discussed, and the correctness of the tests made by these instruments by the inspectors was fully sustained, and also the comparisons made by Dr. McFarlane, Chief Analyst for the Inland Revenue Department of the Dominion Government, corresponded very closely with tests of the same milk by the inspectors. These proofs are more valuable than any demonstrative act of evulsion made by those who are opposed to the testing of milk. One reason why there is opposition to testing of milk is, it is too correct and searching for some parties; it sometimes reveals secrets which some parties would rather keep hid.

There is a very useful way of testing milk, which cheese-makers can very easily and cheaply adopt at factories, that is, by cream glasses. A tin box with a loose cover and as many round holes cut in the cover as there are glasses to be used with milk to be tested. A wood box of the same size and the same number of holes cut in the top board, but so deep as one-third of the cream glasses will be above the cover of the box. This is useful to hold the glasses at all times but particularly when they are to be filled with milk for testing. Now, here is where great care is needful:—1st. To

