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**SALT AS A FERTILIZER.**

From 88 to 99 per cent of the substance of all trees and other vegetables is made up of the four organic elements—oxygen, hydrogen, nitrogen and carbon; the remaining 1 to 12 per cent consists of various mineral substances. The organic portion may all be derived from air and water; the mineral matter must come wholly from the earth. When a plant is burned, the organic portion passes away in the form of gases, and the mineral matter remains as ash.

The mineral substance of plants is made up of 12 elements, which are found in the plant in combination either with each other, with oxygen, or with some metal. These elements are—

Potassium	Chlorine
Sodium	Iodine
Calcium	Sulphur
Silicium	Phosphorus
Aluminum	Iron
Magnesium	Manganese.

The proportions in which these several elements occur in plants vary widely with different plants and in different parts of the same plant; with a given part of a given plant the proportions are pretty constant, though even in this they are subject to considerable modification by the age of the plant, the season of the year, the composition of the soil, and other influences.

Two of these elements—chlorine and sodium—chemically combined, form table salt. Chlorine occurs in plants in minute traces only, but sodium forms a considerable proportion of the ash. It is usually found soda, which is a combination of sodium and oxygen. Chlorine is a green gas, extensively used for bleaching. Sodium is a metal, lighter than water. Its affinity for oxygen is so great that if thrown upon water, it decomposes the water, combining with the oxygen to form soda, and setting the hydrogen free.

Meyen and Sprengel ascertained that salt is decomposed in the leaves of plants, the chlorine being given off, and the sodium, combining instantly with oxygen to form soda, remaining in the plant. Perhaps the bleaching of cloth spread upon grass is in part due to the action of chlorine thus eliminated. This decomposition takes place only in the night.

Soda, resulting from the decomposition of salt, affects the growth of vegetation, not only by contributing its substance to build up the structure of the plant, but also in two or three less direct ways. One of these is by aiding in dissolving the mineral constituents of the soil. One of the principal ingre-

dients in the ash of plants is silica; this mineral is abundant in nearly all soils, but it is not soluble in pure water. By the addition to water of potash or soda, its power of dissolving silica is materially increased.

Soda also exerts a powerful influence in dissolving the organic constituents of soils; it is therefore a valuable ingredient in compost heaps. In this application it may be obtained from salt, by adding quicklime to the heap, in about equal proportions with the salt.

It has been suggested that there is a third action of soda in vegetable growth—that curious and mysterious property which some bodies have of effecting a combination between other bodies without undergoing any change themselves. They perform the part of managing mammas, in making matches between others. It is supposed that salt in soda may perform this catalytic office within the tissues of the growing plant, but there is no positive proof of such action.

The influences of salt being thus various, and in part unknown, it is of course impossible for chemical science to determine whether in any given case its use would be profitable or otherwise. This can only be ascertained by experiments, carefully and intelligently conducted. But there are a few facts known which may be useful in giving direction to experiments.

Both soda and potash are found in the ashes of nearly all vegetables, but, as a general rule, soda predominates in the ashes of marine and sea-shore plants, while potash occurs in larger quantity in the ashes of land plants.

As districts in the immediate vicinity of the sea shore are watered by salt spray, the use of salt in these localities would be less likely to be beneficial than in inland situations.

From the different proportions of soda contained in the ashes of various plants, it is probable that some kinds of crops would be more benefitted by salt than others. Among those most likely to be benefitted are turnips, potatoes, clover and grasses.

Positive conclusions, however, are to be reached only by experiment, and there is perhaps no better subject for a liberal money prize from some of our agricultural societies than the best series of experiments to test the value of salt as a fertilizer.

**THE LENOIR GAS ENGINE.**

We have, in previous numbers of the SCIENTIFIC AMERICAN, adverted to this engine, describing its construction and general principles of action. It is now being extensively used in France, where the inventor first introduced it, and is gradually finding favor in this country, as arrangements have been made to manufacture it here. It is used with common street gas, and the boiler, which is a necessary appendage of the steam engine, is, of course, not needed. The practical utility of such machines depends solely upon their economy, and not upon the degree of ingenuity apparent in their details, and it is therefore interesting to know that this machine produces a horse-power for about twelve cents per hour, at the present rate of gas per cubic foot, which is very high. Half-horse power machines are built which run at the same rate, six cents per hour—this cannot be considered exorbitant.

A curious fact attending the introduction of this machine here is, that the heat generated by the combustion of a given quantity of gas is much higher than that given out by a similar quantity abroad. This occasioned some little mechanical difficulty, which has been remedied. These engines generally run at an average velocity of 175 revolutions per minute, and can be easily managed by any one. We look upon machines of this class as highly desirable for many purposes where steam is objectionable, and we learn that many of them are in use in different places for driving light machinery. Those interested in such things can see one of these engines in operation at the Dry Dock Iron Works, foot of Tenth street, East River, this city.

**FOOT-POUNDS OF WORK.**

Work is the overcoming of physical resistance, such as the crushing or breaking of bodies, the displacement of fluids, or the raising of weights. The simplest mode of measuring and expressing a given

quantity of work is the raising of weights; and the raising of any body weighing one pound one foot in height is called a foot-pound of work. The raising of 1 pound 10 feet high, or the raising of 10 pounds 1 foot high, is 10 foot-pounds of work.

It will be observed that the amount of work is entirely irrespective of the time in which it is accomplished. A foot-pound of work is the raising of 1 pound 1 foot in height, whether one second or one hundred thousand years be occupied in the operation.

Power, on the other hand, is the energy competent to accomplish a given amount of work in a given time. A horse power is the constant force which can perform 33,000 foot-pounds of work in every minute of time.

**A UNIT OF HEAT AND SPECIFIC HEAT.**

In measuring the temperature of any substance or body by a thermometer, the quantity of the substance or the size of the body have no influence upon the indications; these are the same if we employ a pint of water or the whole ocean. Philosophers have, therefore, sought for some mode of measuring or expressing quantities of heat. The plan which has been adopted is to take as the unit of quantity of heat the amount required to raise the temperature of one pound of water one degree of Fahrenheit's scale. This is the English and American unit of heat.

The same quantity of heat that will raise the temperature of one pound of water one degree will raise the temperature of one pound of iron nine degrees, or of one pound of mercury thirty-three degrees. This different capacity of various bodies for heat is called specific heat. Water has the highest specific heat of any substance known, except hydrogen, and is taken as the standard; the specific heat of other substances being expressed in fractions. The following table is given by Prof. Silliman, most of the figures having been originally taken from the experiments of Regnault.

TABLE OF SPECIFIC HEAT—WATER—1-1000.

SOLIDS.	
Aluminum.....	0.2143
Sulphur.....	0.2026
Iron.....	0.1138
Cobalt.....	0.1070
Nickel.....	0.1086
Copper.....	0.0952
Zinc.....	0.0956
Selenium.....	0.0762
Tin.....	0.0562
LIQUIDS.	
Mercury.....	0.0331
GASES AND VAPORS (equal weights.)	
Atmospheric Air.....	0.2379
Oxygen.....	0.2182
Nitrogen.....	0.2440
Hydrogen.....	3.4046
Chlorine.....	0.1214
Bromine.....	0.0552
Nitrous Oxide.....	0.2238
Nitric Oxide.....	0.2315
Carbonic Oxide.....	0.2479
Platinum.....	0.0324
Lead.....	0.0314
Phosphorus.....	0.1887
Arsenic.....	0.0814
Silver.....	0.0570
Iodine.....	0.0541
Antimony.....	0.0508
Gold.....	0.0324
Bismuth.....	0.0308
Bromine.....	0.11094
Carbonic Acid.....	0.2164
Sulphide of Carbon.....	0.1576
Sulphurous Acid.....	0.1553
Ammonia Gas.....	0.5080
Olephant Gas.....	0.3694
Water Vapor.....	0.4750
Alcohol Vapor.....	0.4513
Ether Vapor.....	0.4810
Chloroform.....	0.1568

A knowledge of the specific heat of substances is of value in many practical applications. For instance, on the railroad over the mountains from Italy to Austria, the cars are warmed by means of vessels of hot water, which are changed at the several stations. From its high specific heat water is peculiarly suitable for this use, as a pound of it, in cooling a given number of degrees, gives out nine times as much heat as a pound of iron, and thirty-three times as much as a pound of mercury.

**CHEAP SOLVENT FOR GOLD.**

It is well known that there is no single acid which will dissolve gold, but that this metal is readily soluble in a mixture in the proper proportions of nitric and muriatic acids. This mixture has long been known as *aqua regia*, royal water. It is composed of 1 part nitric acid of 32° Beaume=1.28 specific gravity, and 4 parts hydrochloric acid of 22° Beaume=1.178 specific gravity.

As the idea has been advanced of employing this liquid for extracting gold from quartz in place of the usual process of amalgamating with mercury, Professor Seely, without indorsing the plan, suggests that if any miners or mining companies wish to try it, *aqua regia* might be more cheaply prepared by using certain salts, containing one of the acids, than by employing both of the acids in their pure form.

One of these plans is to mix together a solution of salt—chloride of sodium—in water, and nitric acid. Under the action of the nitric acid both the salt and the water are decomposed; the sodium of the salt