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**The Gardeners' chronicle and agricultural gazette.**

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1844.

Liebig. Under the head of oxygen, also, in the same group, a slight proportion of sulphur and phosphorus is included. I have taken round numbers to avoid the inconvenience of decimals.

Of the Inorganic Principles; iron, sulphur, phosphorus, and silicon, are elementary. Muriate of soda, or, more properly speaking, chloride of sodium, consists of two elementary principles, chlorine and sodium; and the salts of potash, or magnesia, consist of carbonic acid and the oxides of potassium and magnesium.

With the exception of gelatine, which is produced by the metamorphosis of albumen, the above are also the constituents of all animal structure. The world of vegetable and animal life is, in reality, resolvable into the following elements:—

Oxygen  
Hydrogen  
Carbon  
Nitrogen;

with deposits in cellular structure of one or more salts of the following:—

Calcium or Magnesium  
Sodium or Potassium  
Phosphorus  
Iron  
Silicon

These elements, moulded into being by the hand of Creative Wisdom, and endowed with the mysterious and incomprehensible principle of life, become converted into the endless races of animals—immense forests—the deep water of the sea, or the atmosphere that supports and retains the vitality of living beings.

Now, I do not consider that much knowledge will be gained by the Agricultural student of chemistry, by confining himself with minute descriptions or details of particular analysis; instead, therefore, of a great array of figures, which nobody can understand but chemists themselves, I shall content myself by making some simple observations separately upon each of the constituents of plants.

Of the Saccharine Groups: Sugar, Starch, Gum.—There are two varieties of sugar, one derived from the cane, called CANE SUGAR; the other produced by the transposition of the elements of starch in ripening fruits, called GRAPE SUGAR. It is the latter of these, as an element of food and a constituent of plants, which I shall consider here.

If you cut an unripe Apple or raw Potato, and rub the cut surface upon a grater, a solution of very fine flour of pure starch will be obtained. In the unripe Grape, in Turnips, Mangold Wurtzel, the grain of Wheat, Barley, or Oats, Beans, Peas, &c., it is very abundant. In the process of ripening fruit, which we well know requires heat, this starch is converted into sugar by a simple transposition of elements, which a reference to the composition of the substances will show (*vide table*). This change also takes place in the process of malting, the success of which operation depends upon the existence of the principle of life in the seed. Now this vital principle, of the nature of which we know nothing, and very probably never shall, is, from the commencement to the end of life, constantly effecting the most profound chemical changes in the living body. In the instance before us, chemical action is induced to convert the starch into food for the embryo plant. During the change, a reference to the table will show that carbonic acid is constantly set free. Now this carbonic acid nourishes the embryo plant, precisely in the same way as the carbonic acid, which results from the decomposition of humus, nourishes it in a future state of its existence. But the maltster wants all the sugar he can get in his malt. When, therefore, the experienced maltster finds by the length of the germ or root that the ever-acting chemist, life, has changed the whole of the starch in the seed into sugar, he destroys the life of the embryo by heat. If he did not do this at the proper time, his malt would be spoiled, for the growing plant requires food, and quickly appropriates the sugar to its own use. As an instance of the transposition of chemical elements, let us pursue this digression a little further; when the malt comes into the hands of the brewer, his object is to obtain an alcoholic solution, called beer. He first dissolves all the sugar in the malt by boiling, after which his object is simply to convert the sugar into alcohol; in equivalents the following is the composition of alcohol and Grape sugar:—

	Alcohol	Carbon.	Hydrogen.	Oxygen.
Sugar	4	12	6	2
			14	14

By chemical calculations, which would be out of place here, it can be proved that the results of the change in the sugar is alcohol, carbonic acid, and water; the carbonic acid being given off during the change or fermentation, and the water serving as a solvent for the alcohol.

Now this fermentation is produced by the action of life. Yeast is a plant of a low organisation, and is constituted of a number of small spherical cells united together in a line. Each of these cells contains many germs, which, by the constantly-repeated deaths and bursting of the parent cells, become free, and form full-grown cells themselves. In this manner the yeast-plant rapidly grows throughout the cask of sweet-wort, and produces the change of sugar into alcohol, with the constant escape of carbonic acid from the surface, which is called "the working of the beer." The importance, then, of sugar existing in plants, either as a distinct compound, or by its elements in the form of starch, will be apparent.

Starch, or principles similar to it, exists in all plants connected with Agriculture. It is an essential ingredient in the food of animals, because it is absolutely necessary to support the functions of respiration and animal heat. It is a valuable principle to the farmer, for it is necessary in food to produce fat; and it is equally essential to the

reproduction of the crop, for without it seed would not germinate.

Gum is found in the bark and wood of all plants. It is well known in its simple form as gum arabic, and it is highly nutritious both to man and animals. Six ounces of gum arabic have been found sufficient to support an adult man or woman for twenty-four hours. This, however, could not continue long, as the want of azotised food would prove fatal to the experimenter. The same remark applies to sugar and starch; they are highly nutritious as supporters of respiration, but alone are incapable of supporting animal life. Woody fibre, which is very nearly the same in chemical composition in all plants; in the Turnip-top, or the ship's mast; is represented by the Saccharine group\*. It is, in fact, very easily converted into sugar; 100 parts of linen rags will yield 114 of sugar, when treated with sulphuric acid.

As I have not attempted a chemical dissertation upon the different parts of the plant, I have said nothing about the sap. I may observe, however, that the ascending sap is nearly similar in all plants, but that important changes take place during its circulation in the leaves. Much interesting and valuable information on this point, written with peculiar clearness, may be found in Professor Henslow's Letters to the Farmers of Suffolk, or Dr. Carpenter's Popular Cyclopædia, vol. Vegetable Physiology and Botany—a very excellent and cheap publication.—C. R. Bree, *Stowmarket*.

(To be continued.)

Home Correspondence.

Superphosphate of Lime.—The following is the best process for forming superphosphate of lime and other salts of phosphoric acid. I give the process that I used before I possessed appropriate machinery for mixing the acid with the bones. By means of this machinery I am capable of greatly reducing the quantity of water which is otherwise necessary to effect the complete decomposition of the phosphate of lime. Calcined bones are to be reduced by grinding to a very fine powder, and placed in an iron pan with an equal weight of water (a cast-iron trough, such as are sold for holding water for cattle will do); a man with a spade must mix the bone with the water until every portion is wet: while the man is stirring an assistant empties at once into the pan sulphuric acid, 60 parts by weight to every 100 parts of bone; the acid is poured in at once, and not in a thin stream, as commonly recommended; the stirring is continued for about three minutes and the material is then thrown out. With four common farm-labourers and two pans, I have mixed two tons in one day, the larger the heap that is made the more perfect the decomposition, as the heap remains intensely hot for a long time. It is necessary to spread the superphosphate out to the air for a few days, that it may become dry. The great mechanical difficulty of reducing unburnt bones to a very fine powder renders the formation of superphosphate of lime from them very difficult, but common bone-dust in a pure state (that which is sold contains about one-third of lime) may be decomposed by boiling it in a leaden pan with half its weight of sulphuric acid and twice its weight of water, which may afterwards be dried up with sawdust or clay-ashes.—J. B. Lawes.

In what do the Fertilising Qualities of Bones consist?—There seems still to be some doubt in the minds of some of your readers whether the phosphate of lime, or the gelatine, is the fertilising substance in the bone? I would suggest the following experiment, which I have tried myself, and which has satisfied me that the animal matter in the bone merely acts by yielding, by slow decomposition, phosphate of lime in a state capable of being assimilated by plants; and to the phosphate of lime being in a similar state in guano, and not to the ammonia contained in it, may be attributed the powerful effects of this valuable manure. To every 100 parts of large bones add 400 parts of water and 100 parts of muriatic acid, let it stand for four or five days, and then drain off the liquid, and add the same quantity of fresh water and acid four times; by this means the whole of the phosphate of lime will be dissolved in the liquid, and the bones will retain their original form; they must be repeatedly washed until the water ceases to taste acid, then dry them in an oven, and rub them to powder. Evaporate the whole of the liquid in which the mineral matter of the bone was dissolved until nothing but a dry paste remains; heat this to redness, rub it to a fine powder, and convert it into superphosphate of lime in the manner already described. Let two equal quantities of ground be sown with Turnips, strain the seed and one of these two manures together, and the result will satisfy the most sceptical. I have lately seen a large quantity of Swedes growing upon the light sands of Norfolk, in which four bushels of my superphosphate of lime per acre were used, and the crops were excellent,—the superphosphate was formed from calcined bones which did not contain one-half per cent. of carbon.—J. B. Lawes.

A Word in Favour of the Rooks.—Having observed in the 4th Number of the *Agricultural Gazette* that a meeting had been held in the town of Dumfries, Scotland, for the partial destruction of the rooks in that district, we beg leave to offer a few remarks in their favour. These birds certainly eat grain and Potatoes, but it is much to be questioned whether, when following the sower in the field, they are not more intent upon the larvae of numerous insects, which the operation of ploughing and harrowing brings to the surface, than upon the grain which is scat-

\* Starch, sugar of milk, woody fibre, cane-sugar, and grape-sugar, all contain the same quantity of carbon, united with different quantities of oxygen and hydrogen, in the proportions to form water.—Turner's Elements, p. 921.

tered amongst them. The crops of these birds, at the period under consideration, will be found to be more abundantly stored with worms and various insects, both in their larva and perfect state, than with grain; and what they do eat would not be the tenth of what would be consumed by the insects which they destroy. We find the following in behalf of the rooks in the "American Farmer." "Every crow requires at least one pound of food a week, and nine tenths of their food consists of worms and insects; 100 crows, then, in one season, destroy 4,780 lbs. of worms and insects." From this fact some idea may be formed of the benefit of this much persecuted bird. Were it not for these useful birds our fields would soon swarm with the larvae of insects, which would, if left to have their own way, let neither man, bird, or beast reap the fruits of the earth. If we look to those countries where these useful birds are persecuted, we shall find that the formidable cockchafer (*Melolontha vulgaris*) and other destructive insects, destroy nearly the whole of our field and orchard crops; while in those places where these useful birds are allowed to remain unmolested, the ravages of these destructive insects are unknown. Natural instinct seems to direct the rook to this species of food, while man is unconscious of the circumstance. Thus we often see flocks of these birds busily employed in grass-land and meadows, picking up food which is not visible on the surface. From observation we can assert that their employment in such cases is in perforating the surface-sward with their bills to search for the larvae of different insects, which are, at the same time, actively devouring the roots of the grass. Even while engaged in this important service, the husbandman in nine cases out of ten drives them away. In this district the rooks migrate as soon as the operation of sowing is finished, taking with them their young, spending the most of the summer on large heaths and moors but scantily supplied with food. They again return to us towards autumn to destroy the perfect insects, many of which begin at this time to deposit their eggs. At this period rooks do infinite good, as for each insect they destroy they are the means of destroying many. It has been observed that the sole employment of the rooks for three months in spring is to search for this kind of food, and the havoc a numerous flock makes amongst these destructive insects must be very great.—J. Mc L., *Hillsborough*.

Preservation of Root Crops.—The usual method of storing Swedes, either by earthing up in the field or covering in pits, is liable to objections. Having preserved Carrots by cutting off the upper part as well as the green top, and letting them remain earthed up in the ground where they grew, I have this season been induced to try the same method upon a small patch of Swedes. If covered in the field they sprout, and otherwise lose much of their nutritive properties; if put into pits the fermentation which takes place is still more injurious in this way. By letting them remain in the ground, preventing germination and covering the top with mould, I believe we shall best succeed in preserving their enriching properties uninjured. The process of cutting off the top may be done with a hoe, but it requires a deep cut beyond the germinating circle, and all that is cut off should be taken to the sheep-fold, so as not to waste a leaf. The earthing up is a very easy process—supposing the Turnips drilled, as the double mould board plough drawn between the rows is sufficient.—S. C.

Another New Manure.—I send you a specimen of the dung of Bats, received from Jamaica. It is found in considerable quantity in the Caves near Dry Harbour, and in the Guy's Hill District, in the parish of St. Ann, in that island. The following analysis is by F. J. Fleming, Esq., a Member of the St. Ann's Agricultural Society:—

500 Grains of the Matter appear to be composed of

Water of Absorption	116
Uncombined Phosphoric Acid	4
Oxide of Iron	3
Phosphate of Lime	181
Carbonate of Lime	16
Animal and Vegetable Matter, giving out a fetid gas by combustion	99
Matter indestructible by Heat	81
<b>Grains</b>	<b>500</b>

This substance, which is of a dark or chocolate colour, is expected to prove a highly valuable manure; it had been tried by covering it with earth in the cane-hole; but a writer in the *Jamaica Times* suggests that it should be used broadcast, being previously mixed with wood-ashes or powdered charcoal.—T. E.

Bones.—The supply of Bones for crushing is not now so plentiful as formerly. There are large quantities of the bones of the small Whales, which are killed in hundreds at a time, lying on the sea-beaches of Orkney, Shetland, and the Faroe islands, and which probably may be had for the trouble of collecting. It may be well for those concerned in crushing bones for manure to look to these quarters; and also to induce Whale fishers, who go to the Greenland seas, to save as great an amount of the skeletons as possible, to be brought home; or to have them towed on shore, to be sent for afterwards. The Seal fishery might also supply a very large store.—G.

Sleeping Seeds.—It may not be uninteresting to know that the practice of sleeping seeds, recently brought under the notice of the Highland Society by Mr. Campbell, of Dundee, was tried 150 years ago, as appears from the subjoined extract from the "Farmers' Magazine" for December, 1810. The experiment there mentioned seems to have been even more successful than those of Mr. Campbell. To him, however, the farmer's thanks are due for reopening the subject, at a time when the attention of eminent scientific men is so much directed to making their discoveries available for the purposes of Agriculture:— "Charles Miller, son of the celebrated botanist, published