

FERTILITY DUE TO SOIL STRUCTURE

Prof. Hogenes Speaks at the State Normal School.

KINDS OF USES OF MOISTURE.

University and College Co-operate in Giving Agricultural Nature Lessons.

Prof. J. C. Hogenes of the Agricultural college was a visitor today at the university and spoke before the natural science class on the fertility of the soil. The lecture was in the form of a practical demonstration of the properties of a fertile soil, and was illustrated by experiments on osmosis and soil moisture. It showed how these facts and principles could be taught in the public schools, and contained technical matter of importance to those interested in agriculture. A summary of the demonstration follows:

WHAT CONSTITUTES A FERTILE SOIL?

The fertility of a soil, we generally mean its power to produce crops. If it produces good crops, we say that it is a fertile soil. If it does not produce good crops, we say that its fertility is low. The fertility of a soil depends upon six general factors: 1, good texture; 2, sufficient moisture; 3, sufficient available plant food; 4, a sufficient amount of humus; 5, sufficient oxygen; 6, sufficient heat. We shall discuss these six factors, not from the point of view merely of giving information, but to show how these studies may be taken into the schoolroom and how some of the most fundamental truths of agriculture may be practically learned by the children. Children learn to love the soil when they intelligently work with it and make it produce something.

SOIL TEXTURE.

The soil is made up of very small particles called soil grains. These in the clay are so small that it takes 25,000 of them placed side by side to make a linear inch, while coarse sand and about 27 will make an inch. The texture of a soil depends upon the size of its grains and the way in which they are grouped into compound clusters or kernels. In all agricultural soils, no soil grain is separated from the other grains. They are grouped together, forming larger kernels; and the size of these compound kernels determines the texture of the soil. Sand does not have the compound structure. Each sand grain is single and by itself. We say that a soil is in good tilth, that is, its texture is the best for plant growth, when its compound kernels are neither too fine nor too coarse and when they are not too firmly cemented together. (Samples of soil in good and poor tilth were exhibited.)

A clay soil has very fine particles, the soil grains, usually aggregated into larger kernels, but whenever this and the small grains fall close together, it is almost impossible for either air, water, or plant roots to enter it. The water is then said to be puddled. If air and is plowed or otherwise broken down, then it is too wet, the cementing power in these compound kernels is very weak and they are easily broken down, so that puddling is the result. When puddled soil dries, large, hard clods are produced and we have a very poor soil. A good experiment to be carried on in the school room: Take two cases, in one put soil in good tilth, and into the other put puddled clay. Plant wheat in both cases and note the result. The seeds in the puddled soil will not produce plants, while those planted in good soil, germinate and grow. This test will become a valuable lesson to the child and will illustrate the importance of soil texture.

FREE WATER.

There are three kinds of soil moisture: 1, Free water, or the water found in the spaces between the soil grains. Free water is subject to the action of gravity, and sinks or flows down into the soil. It is found in soils after a rainstorm, but soon passes deeper into the soil. It is of very little use to plants.

CAPILLARY MOISTURE.

2. The second kind of soil water is called capillary moisture. This form of soil moisture is that in which the plant foods are dissolved and is of the most use to plants. It is found in a film around each soil grain. From each soil grain this film of water dissolves the plant food. The root-hairs reach out in all directions and come into immediate contact with the soil grains and the films of water which surround them. It is here that osmosis takes place. Unlike free water, capillary moisture may move in all directions in the soil. The direction usually is either toward the plant roots or toward the surface of the soil.

HYGROSCOPIC MOISTURE.

3. The third form of soil water is

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duce the children to observe and to reason, and may lead them to put it into practice in farm or garden.

SOIL MOISTURE.

The second factor of soil fertility is sufficient moisture. Without moisture, life cannot exist, and this is as true of plants as it is of animals. Plants take food from the soil in a liquid form only. It must be in solution. Plants make use of nothing but dissolved plant foods which are there, and this liquid is then taken into the plant roots by a process known as osmosis. It is a natural law that where two liquids of different density are separated by a membrane, the less dense liquid will pass through the membrane until the same density exists on both sides of it. In the soil, the walls of the root-hairs act as a membrane. The soil-sap within the plant is more dense than the solution outside in the soil, so that osmosis takes place and the solution passes through the thin walls of the root-hairs into the plant. This may readily be illustrated by taking a common thistle-tube and tying a piece of parchment over one end. Partly fill the tube with syrup and place in a glass of water so that the syrup inside the tube and the water outside will stand at the same level. The soil grain is really like a thistle-tube, which may rise in the tube till it overflows.

An alkali soil is one that contains so much of the mineral matter of the rock or soil substance, that the soil water is really denser than the solution within the root hairs of the plant itself. The result is that osmosis or flow of the liquid is then from the roots to the soil water, the latter being the more dense. The plant in this case loses the nutriment already has, instead of gaining it. It already has, instead of gaining it, because there is too much plant food held in the soil water.

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called hygroscopic moisture. This form is of no use to plants. It exists as a very thin film around each soil grain. It is part of the capillary water, but is so closely held by the soil grains that plants cannot make use of it. The attraction which the soil grain has for it is greater than the attraction which the plant root has, hence it remains with the soil grain. In a sandy soil, plants have the power to use all the capillary water down to within about 4 per cent, which remains as hygroscopic water. In clay soils, plants cannot use the water if less than 11 per cent of moisture exists in the soil. This 11 per cent is the hygroscopic water that still remains in the soil after it has become air-dry. To show that ordinary dry soil does contain water, we may heat a test tube half filled with very dry soil or dust. We shall see the moisture condense on the cold glass in the upper part of the tube. This is hygroscopic moisture driven from the air-dry soil grains.

A soil that is fine grained will retain more water than a coarse grained one. This is because the fine soil is exposed to hold the moisture in a fine film than in a coarse soil. When water enters the soil, it first forms a film around each soil grain. When these films have reached a definite thickness, the surplus water remains as free water, is subject to the action of gravity, and hence may run off. If now, the clay soil has 11 per cent of moisture, the coarse sand's one grain, we can readily see how the thousand films of water in the clay will contain more water than the one film in the sand.

FILM MOISTURE EXPERIMENT.

All soils are composed of grains; but the size of the grains varies between wide limits. Here is a tube filled with coarse shot, and another filled with shot of a much finer size. We now shall see (1) how much water each tube will contain among the shot, and (2) how much water will be retained after the large shot is removed and the fine shot is put in. We pour the water from each tube. We pour in the water from the coarse shot, and the water runs out. In the fine shot, the water is held in the spaces between the grains, and it holds it at all depths. First we pour into the tube containing the finer shot. The fine shot holds 24.5 cubic centimeters of water to fill to the top of the tube. The tube containing the large shot holds 32 cubic centimeters. This is a tube filled with a given weight of fine shot holds 2.5 cubic centimeters more water than the coarse shot, the same weight of coarse shot.

Now pour out the water from the coarse shot tube. We get back 28 cubic centimeters of water, that is, the large shot retains 4 cubic centimeters as film moisture around the separate shots.

Four the water from the fine shot tube. Now we get back only 24 cubic centimeters, that is, the fine shot retains 16.5 cubic centimeters of water. This shows in a simple way that the finer shot in this instance retain about 24 times as much film moisture as the larger size shot. The smaller the particles of the one and the coarser the particles of the other, the greater the difference will be in amount of water retained, as film moisture. So it is with soils.

A fine soil, say of clay, will hold more capillary and hygroscopic water than a coarse or sandy soil. This is because the number of the soil particles in the fine soil is so much greater than in the coarse. Each grain is coated with its own film of moisture. The difference in the amount of water held by the grains of each soil will vary as the surface exposed to the water varies.

A marble just one inch in diameter will just slip inside a cubic of the same soil, and will hold a film of 3.1416 square inches in area. It will take 1,000 marbles each one-tenth of an inch in diameter to fill up the same cubic inch of space. But the aggregate surface of these 1,000 marbles is 31.416 inches. If the diameter of the spheres is reduced to one-hundredth of an inch, enough of them to fill a space of one cubic inch, will have a surface of 31.416 square inches, and there will be 1,000,000 of them. But if the diameter is only one-thousandth of an inch, it will require 1,000,000,000 of them to fill a cubic inch, and the aggregate surface will be 314.159 square inches.

In the case of very fine soil, in which the measured diameters of the soil grains have been found to be four millionths of an inch, a cubic foot will have a surface capacity of 37,700 square feet. Some soils five feet deep in ordinary field conditions hold from 12 to 12 inches of water.

THE BEST DOCTOR.

Rev. B. C. Horton, Sulphur Springs, Tex., writes, July 29th, 1902: "I have used in my family Ballard's Snow Liniment and Harebrand Syrup, and they have proved certainly satisfactory. The liniment is the best we have ever used for rheumatic and pains. The cough syrup has been our doctor for the last eight years." Sold by Z. C. M. I. Drug Dept. B.

"LOWER MAIN STREET OF THE FUTURE," forms the theme of the illustrations on the front page of the Christmas News. The subject is by a well known artist and will be executed in color. Ready next Saturday.

PRESIDENT SENDS CONDOLENCES TO GUSTAF.

Washington, Dec. 9.—The president today sent a telegram of condolence, addressed to the new king at Stockholm, as follows: "I deeply sympathize with your Majesty and with the people of Sweden in the loss of an honored father and a venerated sovereign."
"THEODORE ROOSEVELT."

PACKING CASES ADVANCED.

Washington, Dec. 9.—The supreme court of the United States has been hearing of the cases of the United States vs. the Armour, Swift and other packing companies, involving the charge of accepting rebates on shipments for exports, for January 20, thus advancing the cases on the docket.

WOMAN FOUND MURDERED.

San Francisco, Dec. 9.—Mrs. Mary Vincent, owner of a lodginghouse at 304 Montgomery avenue, was found dead in her room this afternoon. She had four bullet wounds in her body. The murderer escaped, and the police are not certain of his identity but suspect a Portuguese. Until recently Mrs. Vincent lived in Alameda with her son, Fred, and was reported to be engaged to A. S. Brown. On coming to his city she is said to have transferred her affections to Beagle. At first Beagle was thought to have committed the crime, but later the detectives say they obtained evidence pointing to Beagle, for whom they now are searching.

NATIONAL BANKS.

Bill Introduced Making It Misdemeanor to Print Untrue Statement.

Washington, Dec. 9.—Representative Dalglish of Pennsylvania today introduced a bill making it a misdemeanor to publish any false or derogatory statement about a national bank and penalizing such an act by fine or imprisonment.

DROWNED IN THE BREAKERS.

Santa Cruz, Cal., Dec. 9.—The unusual tidal wave that resulted in the drowning of John Day of Clovis, Ariz., an engineer on the Santa Valley railroad, was here today, and accompanied by his niece, was being from Treasure pier. The breakers washed him off a small boat and before help could reach him.

PILES CURED IN 6 TO 14 DAYS.

PAZO OINTMENT is guaranteed to cure any case of hemorrhoids in 6 to 14 days or money refunded, 50c.

LAST STAGE OF STOESEL TRIAL

Accused of Surrendering Port Arthur Before Exhausting All Resources of Defense.

TWO OTHERS ARE INVOLVED.

Gen. Fook of Conspiring to Surrender And Gen. Reiss of Having Executed the Order.

St. Petersburg, Dec. 9.—The final stage of the court-martial of Lieut.-Gen. Stoessel will begin in this city tomorrow. There have been protracted delays in taking the testimony in the far east, but now this material is in order and proceedings will go ahead rapidly.

Gen. Stoessel is accused of having surrendered the fortress at Port Arthur before he had exhausted all the resources of defense. The punishment for this, under the Russian code, is death. He is to be tried also on the charge of lacking initiative and with having executed his powers. Gen. Fook and Gen. Reiss are co-defendants with him. The first is accused of having conspired the surrender of the fortress, and the second with having executed the order of surrender. Gen. Smirnov, Gen. Stoessel's most bitter enemy, is to be tried on a minor count. The court will be composed of nine generals under the presidency of Vice Admiral Douabassoff. It will include Gen. Kuropatkin, Billderling, Myloff and others. Gen. Garsky will be judge-advocate, and Gen. Smirnov will be defended by Deputy Stryanoff and Col. Vellamoff. The trial is exciting the most intense interest in army circles.

Stoessel is in a pitiable state of excitement over the final hearing of his case, and the doctors are apprehensive of the effect upon the veteran officer, who has suffered two paralytic strokes since the capture of the fortress.

The general told the representative of the Associated Press that he was glad that the trial, after its many delays, was at last coming to a close. He expects to be fully rehabilitated. The indictments against Gen. Stoessel, Reiss, Fook and Smirnov are full of allegations on the final stages of the case of the fortress and on the confusion which existed in the direction of the defense owing to the ambiguous position of Gen. Smirnov. Nominally, this general held the chief command of the fortress, but actually he was supplanted by Gen. Stoessel, who was little more than the mouthpiece of Gen. Fook.

Before communication with Port Arthur was finally cut off, Gen. Kuropatkin both telegraphed and wrote to Gen. Stoessel, instructing him to hand over the command of the fortress to Gen. Smirnov and to join the Manchurian army. Gen. Stoessel did not follow these instructions. On the contrary, he remained at Port Arthur and arrogated to himself the supreme authority.

Gen. Fook is considered to be responsible for the evacuation of vitally important forts between Dec. 15 and Jan. 1, and the evidence on this point is incontrovertible. The indictments give a terribly graphic description of the casualties which exceeded 400 in a single day, and at another point there were but 30 survivors from a detachment of over 200 men. Nevertheless, neither Gen. Gorbatsky nor Gen. Smirnov admitted the possibility of voluntarily evacuating the defenses, and they both bitterly upbraided Gen. Fook when they heard of his order to do so. The last military council before the capitulation was held at Port Arthur on the evening of Dec. 23.

The council voted 19 to 3 in favor of holding out to the last extremity. Gen. Stoessel took no active part in the discussion, but Gen. Reiss, who recited a number of reasons for surrendering, undoubtedly spoke on Stoessel's behalf. The most sensational part of the indictments relates to the immediate circumstances of the capitulation. On Jan. 1, the day after the evacuation of the fortress, Gen. Reiss and Fook appear to have been the only senior officers remaining at Port Arthur. His only solicitude, witnesses have affirmed, was for his own baggage.

Gen. Reiss was given full power by Gen. Stoessel in the final negotiations. Stoessel did not bid farewell to the troops when they marched out of the fortress after the surrender. He remained for his own use 10 of the 13 cars placed by the victors at the disposal of the Russian women in Port Arthur. His only solicitude, witnesses have affirmed, was for his own baggage.

It will be the duty of the court-martial to determine whether the capitulation of Port Arthur on Jan. 1 was justified according to Russian military codes and ethics. There were probably some 17,000 fighting men left at the time of the surrender. The stock and wounded numbered about 15,000. There is evidence to prove that in the matter of provisions Port Arthur could easily have held out another month, and the reserves of ammunition, both artillery and rifle, would have sufficed for even longer than this. The garrison had 800 effective guns when the fortress was surrendered.

The standpoint taken by Gen. Stoessel, Reiss and Fook is that the fate of Port Arthur was sealed with the capture of "Eagle's Nest" and two other positions by the Japanese, that every point remaining in the hands of the Russians was exposed to the Japanese fire, and that the so-called second and third lines of defense were absolutely valueless.

Gen. Stoessel, Reiss and Fook all possess the St. George's order for valor, which corresponds to the Victoria Cross in the British army.

PASSED EXAMINATION SUCCESSFULLY.

James Donahue, New Britain, Conn., writes: "I tried several kidney remedies, and was treated by our best physicians for diabetes, but did not improve until I took Foley's Kidney Cure. After the second bottle I showed improvement, and five bottles cured me completely. I have since passed a rigid examination for life insurance." Foley's Kidney Cure cures backache and all forms of kidney and bladder trouble. For sale by F. J. Hill Drug Co. "The Never Substitutors."

Twenty-four prominent salt-takers, men and women in the days of their youth, accompanied with pictures taken at the time. This forms a charming feature of the Christmas News to be printed next Saturday.

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FOR MONTH OF NOVEMBER.

According to reports from the leading book sellers of the country, the six books which have sold best in the order of demand during the month are:

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2. The Shuttle, Burnett.....\$1.50
3. The Daughter of Anderson Crow, McCutcheon.....\$1.50
4. The Younger Set, Chambers.....\$1.50
5. Satan, Sanderson, Rives.....\$1.50
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The profits from the sale of the book will go to the dead artist's invalid mother. Should there be a surplus, it will be held in trust for the benefit of his infant daughter, to be given to her when she becomes twenty-one years old, or sooner if needed.

The Press club of Salt Lake, which prepared the book, guarantees that no part of the fund will be diverted from its proper purpose. The fund will be under control of the club at all times.

The book, representing months of careful preparation, is in two editions, both of the highest class of workmanship. The deluxe edition, limited to 100 copies, is printed on heavy Japan paper, with leather cover and gold lettering. It sells at \$25, and a few copies are still available for subscription. The popular edition, printed on heavy India tint paper and bound in silk, sells at \$5.

Mr. G. C. Bowen is the authorized representative of the Lorey fund to secure subscriptions for the book, and will attend personally to the sale of it in Utah.

Copies of the book may be seen at the Store of D. A. CALAHAN, 164 South Main St., and at the

Deseret News Book Store