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STUDY OF WHEAT AND BUCKWHEAT BEFORE AND AFTER SPROUTING

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This is the second of a series of bulletins on elementary science, which will be published at the Agricultural College. While they are prepared especially with the view of helping teachers in the common schools, they should interest every enterprising farmer and horticulturist, or any other wide-awake citizen. Enquiries for bulletins or information regarding this work should be addressed to

THE SECRETARY,

Agricultural College, Mich.

Bulletin Number 1 was published on Dec. 25, 1897, and is entitled Observing and Comparing Beans and Peas Before and After Sprouting.

OBSERVING AND COMPARING WHEAT AND BUCKWHEAT BEFORE AND AFTER SPROUTING, AND A COMPARISON OF THESE WITH BEANS AND PEAS.

In the first School Bulletin the writer gave young persons some instructions for observing and experimenting with the seeds of beans and Keeping these hints in mind and without further help, pupils are peas. now asked to show their ability in doing similar work with wheat and buckwheat. As with beans and peas, so in the study of wheat and buckwheat, pupils will need boxes of soil or sand, one-hundred or more grains of wheat and the same of buckwheat. They may make the same kind of an examination while the objects are dry and after remaining in water a few hours; they will place some on the surface and others beneath the surface, making notes and drawings, not forgetting to compare wheat and buckwheat with the seeds formerly studied. These seedlings should be watched and compared till they are two or three inches high, especially noting the marked differences between them. In addition to this, some one or more of the willing and earnest girls or boys may place ten or more soaked kernels of wheat on wet sand covered by a dish. Look for the first sign of a sprout, and then at once remove the grain to a dry place and keep there till the tiny sprout is dead, and then replace under cover on wet sand and when growth is renewed, remove as before to a dry place and so keep up the work to see how many times a kernel can be sprouted, each time after drying. One or more pupils may do the same kind of work with buckwheat and see which side will win in the contest. Notes and comparisons may be made as the process goes on and finally reports will be made to the teacher or to the class.

It is sincerely hoped that the teacher will permit one class or more of pupils to complete their experiments and notes before letting them know what is contained in the following portion of the Bulletin.

Below are presented some notes and illustrations, which give a very good idea of what it is hoped some or many of the children will be able to discover and describe. Many other points could be named, and very likely some of the children will discover things which are here omitted.

In examining five dry grains of wheat, they find each differing somewhat in size, shape, color and markings from all the others. The kernel is about one-fourth of an inch long and wrinkled more or less. There is a narrow groove running lengthwise on one side and on the opposite side near one end is a peculiar wrinkled spot nearly circular in outline. At the very base of the kernel near the circular spot, is a small scar where

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the grain was broken from the parent plant. At the tip of the kernel are numerous very short, white hairs. Perfect or well developed kernels of one kind of wheat resemble each other more closely than kernels of different kinds of wheat. Kernels of wheat kept in water three to eight hours, are softened and enlarged and are then mostly free from wrinkles. The circular spot near the base of the kernel has smoothed out, excepting a shallow groove around the outside.

There is much difference between kernels of buckwheat. One kind, known as the silver-hull, has a gray color, and the corners are rounded more or less and the sides bulge out considerably. Another sort, usually known as common buckwheat, is dark brown in color and has three sharp ridges running lengthwise of the kernel, while the sides are flat or more or less depressed. Kernels of wheat and common buckwheat are often nearly of the same length, though in most cases wheat is the longer. The lower



Fig. 13. Grain of backwheat three times natural size.

sheath.

end of a grain of buckwheat is larger than the upper end, and if it were not rubbed too hard in threshing, there will still be found the remains of some brown scales, and at the base a small scar where it was joined to the plant while growing and at the apex of some of the kernels may yet be found three little club-shaped things which usually turn downward near the sides of the grain. The buckwheat after soaking in water is somewhat enlarged and softened.

The circular spot near the lower end of a kernel of wheat kept on wet earth, no matter in what position, is usually soon split open and a short white bunch is thrust out directly away from the kernel. This white sheath soon splits open at the end and a slender root pushes out, and excepting the naked end this root is soon covered by a downy material, the roothairs. Before this single first root has made much prog-

wheat enlarged ress, another one appears on each side, pushing its first a little amaller the pushing its first a little smaller than the first one, but in other respects the same, making three in

number, and before long, still another comes out on either side making five in all. Very likely it may not be long



Fig. 16. Grain of wheat showing five roots, and at the right two leaves are shown, one within the other.

before the side roots catch up and some of them possibly overtake the first one. For a considerable time For before all the roots appear, there is an-white sheath.



other single greenish-white object destitute of hairs and shorter than the roots pushing in an opposite direction.

A kernel of wheat is not heavy and the roots are small and soon clothed with root-hairs. The kernels left on the surface are not unfrequently raised above the soil and kept there by the several roots in a spider-like manner. Sometimes some of the roots grow faster than others and they push the kernel over on its "back," but some of the curving roots aided by the hairs, unless allowed to dry, are sure, sooner or later, to enter the soil and secure water and other materials.

After a kernel has roots half an inch long, we are able to pick out the round spot near the base of the kernel and find the roots at one end and the stem at the other are held together, leaving a mealy and gummy portion in the covering of the grain. This gummy portion is intended to nourish the young plant which has one very small seed leaf.

Where kernels of buckwheat are placed on wet soil and kept covered with something to keep them from drying, the first thing to appear is a tiny, smooth root coming always from the pointed end of the kernel, and if the point of the kernel is uppermost, this root usually turns at once down toward the soil. This root of the buckwheat does not burst out of the larger white sheath as do those of the wheat, but they are smooth and of even size, as were those of the bean and pea. The hairs on the root do not begin to appear till the root is about as long as the grain. The root-hairs do not cover all of the tender portion outside the hull, but have a portion at the base as well as the tip which is smooth. This smooth portion next the kernel is a genuine stem and not a root, and is to the buckwheat what the smooth stem of the bean displayed between seed-leaves and roots is to the bean.

After kernels of buckwheat have sent out sprouts half an inch long, it will be well to $op \in n$ one or two. On removing the dark brown hull, we shall still see a lighter-colored covering, with a queer yellowish-brown circular spot, containing a darker speck in the center, where the seed was attached to the lower end of the hull or covering.



winding through the mealy portion. damp soil for an inch, or sometimes even two inches, before a few side rootlets begin to appear near what is the upper end of the main root where it joins the smooth stem.



Fig. 18. Buckwheat germinating on wet sand showing a stem at c, and one long root, a, b.

Fig. 17. Grain of buckwheat cut across, showing the two thin seed-leaves winding through the

In kernels of wheat that were planted, no matter whether one side or which end was down, the first thing to appear above the surface was a

single, slender, nearly straight light green piece, abruptly pointed and usually carrying one or more drops of water. Like the pea the wheat kernel remains below the surface where planted.

When the light green portion of the sprouting wheat is half an inch or a little more above the soil, if held with the side to the window, one can see that below the tip a little way, the color is darker green, and when up about an inch, more or less, this darker green portion pushes a little way out of the lighter portion. This light lower part is the first true leaf and is a closed tube or sheath for nearly its whole length. The greener portion pushing up out of the tube is the second true leaf, and after it is two to three inches

high it unrolls from each edge and flattens out more or less becoming twisted.

The true leaves of beans, peas and buckwheat are more or less rough and have a small framework crossing here and there, or, more properly the veins, running into each other in many places not unlike the threads of a net while the leaves of the wheat are very narrow with framework extending lengthwise.

The kernels of buckwheat planted in the soil with the point down, are shoved up big end first, with a crook-neck not far from the kernel, while

> the kernels buried with the large end down or the side down, first show above the surface a light-colored bow after the manner of the bean,

Like the bean, the buckwheat sends its seed-leaves above the soil by a clean stem considerably lengthened, connecting the roots below and the seed-leaves above. After coming out of the ground half an inch or more, the lower

part of the twisted seed-leaves begin to show and are of a light green color, the hull still covering their tips. In seed-leaves still time the brown hull drops off and is found to be empty, as by the hull. the tips of the tender seed-leaves apparently took in all of the tips of the tender seed-leaves apparently took in all of

the starchy matter, and then the stem became erect and the seed-leaves spread apart, displaying a little bud between. The seed-leaves do not match each other exactly as one hand of a person matches the other, but the left side of each is larger than the right, giving the plantlet a peculiar appearance.



Fig. 20. Seedling of buckwheat with



Fig. 19. The first true leaf of wheat

peering above the soil consists of a closed sheath or

tube often with a

drop of water near

the top.

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Fig. 21. Seedling of buckwheat, a the first stem, b, b the seed-leaves, c the first bud.

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Fig. 22. A healthy seedling of wheat grown in good soil in the field with plenty of light, aremains of shriveled kernel, b first leaf consisting of a sheath burst open, c second leaf, dbranch bearing three twisted leaves, one above the other. Leaves of wheat while young and later are nearly all twisted in the same direction.

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