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SMUT, IN WHEAT, AND OTHER GRAIN.

There are very few subjects of greater interest to the Canadian Farmer than the one treated of in the following article. The advantages of a careful selection of seed, and of steeping it previous to sowing, are so fully explained and so satisfactorily proved, that we venture to think no farmer who attentively reads what follows, will continue the slovenly and short-sighted practices so prevalent in Canada. The time for sowing spring wheat is now at hand, and we have no doubt many persons will find it necessary to resort to it for their bread. The information in this article will, therefore, be opportune, and as it comes from the very best source, viz., The "Farmer's Encyclopedia," may be relied upon:—

SMUT.

A disease affecting almost every species of corn, the grains of which become filled with a fetid black powder, instead of containing farinaceous matter. Wet seasons, animalcule, organic weakness, deficiency of the parts of generation, and other circumstances, have been assigned as the primary causes of this disease, but all the results of experience are against the opinion that these are more than contingencies which aggravate the symptoms, and accelerate the progress of the infection. That the smut does not arise from a deficient fecundity is apparent, because it affects and destroys the grain long before the sexual organs are fully developed. Fogs, exposure to intense sunshine when moist, or other atmospheric influence upon the ear after it has been protruded, have been assigned as causes; but these cannot be productive of the mischief, for the disease has been observed during an early stage of the vegetation of the ear, and long before it has escaped from the leafy envelopes; this also dismisses the opinion entertained by some that the disease occurs after the grains are fully formed. It does not arise from the too abundant moisture of the soil, because I have universally observed that the driest part of a field are as liable to bear an infected grain as the most wet; and we all know that infected plants stand surrounded by others entirely uninfected. Some persons have thought that insects are the origin of the disease; but the most accurate observations have refuted this opinion, and shown that the diseased grains may be an agreeable nidus for the larvæ, but that these always appear after the disease is matured. Upon examining some of the diseased grains, Mr. R. Somerville found upon them a minute insect, in form like a wood-louse, which I knew from observation to be a species of the scarus, and these he considered the cause of the disease. But this is a conclusion unwarranted by observation, for similar vermin are found upon the roots of the Brassica tribe that are infected with aubury; and, indeed, this genus of insects is invariably found upon a decayed vegetable matter; it is their habitat.

Other persons have thought that the grains injured by the process of thrashing are most liable to the disease; but this is refuted by the fact that it appears in some years, and is scarcely to be detected in others. The Rev. Dr. Hales bruised numerous grains of wheat of different sizes with a hammer, but the result convinced him that this opinion is erroneous. Wolfers thought it arose from a monstrosity of the embryo; but M. Cymon has shown that the male flowers of some

plants suffer from smut as well as the female, and the former we know have no embryo.

Having thus disposed of the several causes which have been erroneously assigned, I will now proceed to detail the more correct knowledge that has been accumulated respecting this plague of our corn crops.

This disease is severally termed *smut dust-brand*, *blight*, *burnt corn*, &c. In France it is commonly known by the name of *charbon* and *nelle volante*. Botanists, aided by the microscope, have discovered that the cause of smut is a parasitical fungus, which preys not only upon the sap, but destroys the very organic structure of the grain and chaff upon which it fixes. The majority of naturalists agree in distinguishing the fungus by the title of *Uredo segetum*; but as the other synonyms, these, and the authors who have employed them, may be usefully enumerated. *Uredo segetum*, Pursh, n. 27; *Chyos ustilago*, Lam. Syst. Nat. 1326, n. 4; *Reticulaire des blés*, Bulliard's L'ungi, vol. 1. p. 90, plate 472, f. 2. *Reticularia segetum*, Withering, iv. p. 383. *Charbon*, Tessier, Des Maladies des Grains, 299. Bulliard describes this fungus as globular, extremely fine, and attached to a fine elastic thread. They are exceedingly numerous, enveloping the seed and chaff of the plants they affect, and are, as well as their own still more minute seed, and an intense black colour, having a disagreeable fetid smell, which has been not inaptly compared to stale lobsters. Mr. Kirby tells us that Mr. Lathbury examined the dust of this fungus under a powerful magnifier, and found it consisted of numerous minute particles, uniform in shape and size, much smaller and blacker than those of the pepper brand, and less easily separable: they seemed to be contained in little irregular cells. This dust or seed is the food of a small, shining, black insect, the *Dermestes ata* of Marsham.

Chemical analysis has demonstrated that this fungus effects an entire decomposition of the vegetable particles of the grain it infects, the saline constituents remaining nearly unaltered in the grain. Purmentier, Cornet, Girot, Chantians, Fourcroy, and Vauquelin, have successively examined it, and the result of their researches is, that smutted grains of wheat are composed, 1st, of about one-third their own weight of a green, butyraceous, fetid and acrid oil; 2nd, nearly one-fourth of a vege-to-animal substance, perfectly similar to that which comes from *putred gluten*; 3rd, a black coal, one-fifth of their weight, similar to that which is found in all remnants of putrefied organic compounds; 4th, free phosphoric acid, amounting scarcely to more than 1/100 of the smut; 5th, phosphates of ammonia, magnesia, and lime, in the proportion of a few thousandths, &c. The ear of corn which is attacked is in general totally destroyed, but sometimes the same ear contains sound as well as smutty grains; and even one end of the same grain has been found diseased and the other end sound. However, as all the grains in an ear are usually infected, so, when one stalk is smutty, it generally happens that all the ears from the same root are so too. In March or April, upon carefully opening the base or blade (*folium vaginans*) which covers the ear, and examining the young ear, although it was not more than one-sixth of an inch long, and almost close to the roots, M. Du Hamel found the embryo already black and distempered; a fact confirmed by the researches of Mr. Kirby. When the diseased ear comes out of the above-mentioned envelope, it looks black and meagre. About half

an inch of the upper part of its stalk is commonly not quite straight. If cut asunder at not more than a quarter of an inch below the ear, it will be found nearly solid or filled with pith; the circulation above is therefore obstructed. The most important point for consideration is, from whence is the infection communicated; and the following experiments will be found to have demonstrated that it is capable of being conveyed to the plants by the agency of the parent seed. These experiments are satisfactory and decisive; for although they are only in accordance with the most prevalent opinions of farmers upon the point, yet prevalent opinions are not always in accordance with truth, and are never to be implicitly received until sustained by evidence, which is independent of prejudice, and more accurate than surmise.

Mr. R. Somerville, in a paper published in the *Communications to the Board of Agriculture*, detailed experiments fully substantiating the fact, that the disease is communicable to the crop from the parent seed. He mixed some smutted grains with others perfectly healthy, and kept them two months; after which, previously to sowing, he rubbed them together between his hands. The sample was then divided into two equal parts, one of which was well washed with clear water three or four times, and then sown in a drill in his garden. The other half was sown similarly, but without being washed or otherwise prepared. The blades appeared above the surface at the same time, and during the first two months of their growth there was no visible difference in their appearance. Soon afterwards many of the plants from the unwashed seed were observed to have a darker and more dirty green hue than those from the seed that had been cleansed with water. This difference of colour by degrees became more striking, and increased until the grain was protruded from the blade, at which time many of the dark-coloured plants evinced symptoms of decay; and the whole of them, when fully developed, were found to be completely destroyed by the smut. The plants from the washed seed produced scarcely a single diseased ear. These results were not fortuitous, for the experiment afforded a similar testimony when repeated the next season.

The experiments of Mr. Harrup agreed with the preceding. In these, wheat, consisting of half of sound and half of smutted grains, was sown without being previously at all prepared, and this produced a crop of which nearly two-thirds were smutted. Similar wheat, soaked for twelve hours in a saturated solution of common salt, and then mixed with quicklime, produced on the same soil, in the same situation, and in the same season, a crop in which not a smutted ear could be found.

Similar, but more extended, and even more accurate experiments, were completed by Mr. Bevan, and are recorded in the ninth volume of the *Agricultural Magazine*. They give the result of his trials with various liquids as steepers for seed-wheat. The wheat was grown on a sandy soil, at Leighton in Bedfordshire.

The conclusion from these and many other accordant experiments is, that washing the seed is effective in preventing the communication of the disease to the crop to which it gives birth. If the washing was frequently repeated, or the cleansing made complete, by passing a continual stream through the seed for some hours, it is probable that simple

water might be employed for this purpose as effectually as any saline solution. But as this would require more labour than is desirable, and as the salts, &c., employed are beneficial in other ways, by protecting the seed from vermin, and ministering to the future vigour of the plants, steepers are generally and very properly adopted.

The experiments of Mr. Bevan indicate that lime-water is the most effective of these preparations; and, if this be adopted, it may be prepared by mixing 1 pound of fresh lime with three gallons of boiling water, and the clear liquor then to be poured off and immediately used. In this liquor the wheat should be soaked for 12 hours, stirred twice or thrice during the time, and then mixed upon a floor, with the powder made by pouring 3 gallons of boiling water upon 4 pounds of lime. I have had no experience of the effects of lime-water as a preventive of the smut; but with stale urine, and a solution of common salt, I have witnessed numerous and extensive experiments. The results, without exception, were favourable and nearly similar; and this being the case, a preference is to be given to common salt, as being decidedly the most cleanly and the least disgusting. The mode which I have observed to be the most effective is, to wash the seed with pure water, pouring this off with all the floating grains, and then allowing the seed to soak for 12 hours in a solution of common salt, having a strength or specific gravity sufficient to float a hen's egg. I have no doubt that lime like common salt, is effectual against the disease, by reason of its powerful action upon the texture of the fungus tribe. Every housekeeper knows how completely mushrooms dissolve away when sprinkled with salt; and in experiments I have made upon the *Uredo segetum*, I found that the effects of common salt upon this fungus is not less remarkable.

Mr. Tull, M. de Lignerolle, Douat, and others, agree in recommending that the seed to be sown upon any farm should be frequently obtained from other soils; but, however beneficial this may be for securing other desired effects, I do not understand how it can prevent the occurrence of smut unless the seed is obtained from a crop and a district notably free from the disease. There is little doubt but that the method in which the disease is imparted to the plant is by its root imbibing the extremely minute seeds of the *Uredo* along with the moisture of the soil. This opinion is confirmed by the observation that the disease is most prevalent when the winter has been mild and the spring wet; for, in such seasons, the abundant moisture passing through the soil is most likely to convey the seeds to the mouths of the plants' radicle fibres.

I remember trying some experiments, the full details of which I have accidentally lost, in which I buried some of the *Uredo segetum* about an inch below the surface of the soil, in a garden pot in which some wheat was growing, supplying those plants, during their after growth, plentifully with water, poured upon the surface of the soil. Not one of these plants escaped infection.

Another garden pot, in which wheat from the same sample was growing, and similarly treated in every respect, but to which moisture was supplied solely by means of the saucer in which it was placed, pots being sheltered entirely from the rain, produced plants which were not at all infected. Although it is very apparent that the smut is generally imparted to a wheat crop by the