SCIENCE

FRIDAY, AUGUST 30, 1918

CONTENTS

MSS. intended for publication and books, etc., intended for review should be sent to The Editor of Science, Garrison-on-Hudson, N. Y.

SPHAGNUM AS A SURGICAL DRESSING[1]

THE world war has produced a "world emergency" which has stimulated to an extraordinary extent the inventive genius of this and practically all nations. This is observed not only in the great development of destructive agents as seen in certain lines of chemistry, aeronautics, submarines and gunnery, but also in the marvelous skill that has developed and the appliances used in surgery. War had been declared only a few months when it was seen that there was likely to be a shortage of absorbent cotton, and in an effort to avert such a calamity experiments were begun with sphagnum, or peat moss, as a substitute. At the present time surgical and non-surgical dressings made from sphagnum are being used in the war hospitals, not only in Great Britain, but in France, Malta, Alexandria, Salonika, Italy and Palestine—practically on all the allied fronts. Doubtless it is also used extensively in Germany, as certain returned prisoners state that part of their work was to gather sphagnum from bogs. How it was used, however, we do not know.

DISTRIBUTION OF SPHAGNUM

Sphagnum is widely distributed throughout the world, especially in the damp humid climate of the colder parts of the temperate zone of Europe, Asia and America. The British supply comes from the moors of Scotland and Ireland, and from Canada. The Germans obtain it from extensive bogs around the Baltic.

In North America it occurs most commonly along the northeastern coast from New England to Labrador, and along the northwestern coast from Oregon to Alaska. In the interior large bogs occur, especially in the region

[1] A fuller account of "Sphagnum as a Surgical Dressing" is given by the writer in a pamphlet published by the Northwest Division of the American Red Cross, Seattle, Washington.

of the Great Lakes. Thus far, however, moss suitable for surgical dressings has not been reported in any large quantities from this region. The excessive heat in summer and the extreme frost in winter creates a condition that is uncongenial for desirable species to grow and thrive.

On the Pacific coast, extending from Oregon to Alaska, large numbers of sphagnum bogs occur. It is estimated that in Washington alone there are 25,000 acres of cranberry marsh. Of course a large proportion of this area does not have usable moss. Most of the bogs in Washington that are close to the Pacific Ocean are "raised bogs," that is, the center is higher than the margin, often a foot or more. Consequently, surrounding each of these is a marginal ditch filled with water. Raised bogs also occur along the northern Atlantic, especially in Nova Scotia and Newfoundland. This type of bog occurs only where there is an excessive amount of moisture and thus most congenial for the growth of sphagnum. Moreover, it is this kind of bog that usually contains the species most suitable for surgical dressings. Hence the most promising fields for the location of suitable surgical moss may be expected along the northern Atlantic and Pacific coasts.

USES OF SPHAGNUM

Sphagnum is frequently called "peat moss," because it, with other plants growing in undrained bogs, eventually make peat, which is used extensively for fuel in some countries. Sphagnum is very commonly used by nurserymen and others for packing; especially is it desirable about the roots of plants when moisture is required for a considerable length of time. A number of varieties of orchids thrive as well in sphagnum as in their native haunts. This moss makes an excellent insulator, much better than sawdust or even cork, but of course it can not be used where it is exposed to moisture. It excels sawdust as a medium for packing and shipping raw fruits, like grapes, because when one bunch "goes bad" the moss immediately absorbs the moisture and prevents the infection spreading. In Sweden some of the coarser kinds of paper, like wall-paper, wrapping paper and building paper, are made from this moss. It is used in Alaska and other places where it is abundant to bind up wounds of domestic animals, particularly when there is some discharge. In such cases the moss is applied directly to the wound. When it is dried it is often used as bedding for horses and other animals. This moss has also been used in Scotland and Ireland as a home remedy for absorbing the discharge from boils and other suppurating wounds. The American Indians made use of dried sphagnum for diapers for their babies. In Alaska they still do it. The Alaska Indians also make a very wholesome salve, used for cuts, by mixing sphagnum leaves with tallow or other grease and working the two well together.

It is known that in Germany a fairly good cloth is made by mixing sphagnum with wool and weaving them together. Promising results have also been obtained when it is used as a fertilizer. Not that it adds much plant food to the soil, but that it acts as a stimulant by holding a large quantity of water. It is of particular value when applied to the roots of trees along parking strips in cities.

Dr. Walton Haydon, of Marshfield, Oregon, used sphagnum extensively while in the service of the Hudson Bay Company at Moose Factory during the years 1878–1884. After the moss was collected and sorted it was sprinkled with a weak solution of carbolic acid. When nearly dry it was stored in a jar with a tight cover until used. In using it a thin cotton dressing was laid on the wound or sore, then a layer of moss and the whole dressing wrapped with a bandage. Dr. Haydon found it best to keep the sphagnum with a small amount of antiseptic moisture in it, as it breaks up and becomes dusty when thoroughly dried.

Sphagnum was used or at least recommended for use during both the Napoleonic and Franco-Prussian wars, and was employed to a limited extent in the Russo-Japanese war. It was not, however, until the present world

war broke out that it became extensively employed as a modern surgical dressing.

Shortly after the war was declared in 1914, Dr. C. W. Cathcart, an Edinburgh surgeon and a lieutenant-colonel in the medical corps of the British army, began experimenting with sphagnum in one of the Scottish hospitals. The first published account of these experiments, together with the general account of the moss as a surgical dressing, appeared in the *Scotsman* of November, 1914.[2] Dr. Cathcart then formed an organization for collecting and preparing the peat moss for surgical pads in Edinburgh. This was the first organization formed for this purpose among the allied nations. In September, 1915, a second one was established in the south of Ireland by the Marchioness of Waterford. The work thus begun was so promising that new organizations sprang up all over Scotland and Ireland under the War Dressing Supply Organization in Edinburgh, and the Irish War Hospital Supply Depot in Dublin. During this experimental stage there was considerable opposition to this kind of surgical pad, but as time went on and the method of making the dressings was improved, this opposition disappeared and in February, 1916, the British War Office accepted them as "official" dressings. With this recognition and organization the work rapidly increased, so that during the summer of 1918 the sphagnum pads produced by Great Britain are numbered in the millions per month, Scotland alone being asked to supply 4,000,000 sphagnum dressings a month.

In America the sphagnum work on a large scale, has been more recent. During the summer of 1916, Dr. J. B. Porter, of McGill University, became interested in peat moss for surgical dressings.[3] Samples were collected in eastern Canada, especially in Nova Scotia, and sent to Britain for approval. It was late in the season before definite reports could be obtained from these samples, so little was done before the bogs were frozen.

In the spring and summer of 1917 this work was continued by the Canadian Red Cross under the direction of Dr. Porter. Although no very large number of dressings was made, yet the organization was extended and perfected, and the bogs containing the desirable moss located, so that if the demand became more urgent the production of this kind of dressing could be readily pushed. This demand came in January, 1918, in the form of an order from the British War Office, for 20,000,000 sphagnum surgical dressings. The Canadian Red Cross is thus doing extensive work along this line during 1918.

After the United States entered the war more interest was taken in this work by Americans but it was not until March 1, 1918, that sphagnum was officially recognized by the National Red Cross of America. At that time a preliminary order for 50,000 pads was given to the Seattle Chapter and these have been made on the campus of the University of Washington under the direction of the writer.

The faculty of the University of Washington, feeling the importance of this phase of War Emergency work and wishing to assist in completing as rapidly as possible this large allotment of pads, voted to require all women of the first and second years of the university to register for two hours a week for moss work during the spring quarter. The request for this work came originally from the women themselves through the dean of women. They felt that since the men were required to devote eight hours a week to military drill without university credit, the women also should do some definite war work under university supervision.

COLLECTING AND SORTING

Before beginning the collection of sphagnum one should know exactly what is needed. There are over forty species of this moss in America of which only four (*S. imbricatum, S. palustre, S. papillosum* and *S. magillanicum*) are at present used for surgical dress-

[2] Charles W. Cathcart and I. Bayley Balfour, "Bog Moss for Surgical Dressings," *The Scotsman*, No. 17, 1914.

[3] John B. Porter, "Sphagnum Surgical Dressings," *International Journal of Surgery*, May, 1917.

ings. Great care should thus be exercised in order that only suitable moss be collected. To this end it is often wise to carry a sample of approved sphagnum for comparison until one is quite familiar with the work.

In the bog it has been found most convenient to take a small handful of moss at a time and to shake it lightly to get rid of most of the foreign matter, such as leaves, twigs, roots, etc. If wet, squeeze out as much water as possible before putting it in the bag, but do not wring it, as that will break and injure the stem.

The depth to which usable moss extends varies with the species and environment. In many cases beds of *Sphagnum imbricatum* may be worked to advantage a foot to eighteen inches or even farther, depending on whether the plants remain intact or whether a partial decay has begun. In general, whenever the plants begin to break up as a result of the first stages of decay, they must be discarded; but as long as they remain intact, with stem fairly well crowded with lateral branches, they may be used, the color playing little or no part in determining the suitability. While gathering moss it is wise to secure all the good moss in a given space before proceeding to another, because after a growth has once been disturbed the adjoining plants usually deteriorate and sometimes die.

After it is taken from the bog the moss should be removed to some shelter and spread out to dry. This may be done on the grass if the weather is fine, otherwise on suitable racks which usually prove more satisfactory, or on the floor of some empty building, although care must be taken not to put it on valuable flooring, as the dampness is apt to do some damage.

The collection of moss is one of the most important phases in the making of sphagnum pads. Much depends upon the condition of the moss when it reaches the sorter if their work is to be most efficient. It has been found that carelessness or thoughtlessness on the part of the collector often decreases the efficiency of the sorter far out of proper proportion.

The most tedious part of making sphagnum pads is picking over and sorting the moss, and this is greatly increased by careless gathering. The sorting should be done in some central place and completed before the moss is dry. If inadvertently the moss becomes too dry it should be spread out in a gentle rain for a short time or sprinkled with water and left over night with an oil-cloth spread over it.

How Sphagnum Pads are Made

Like many other things in connection with this war, the directions for making surgical dressings from sphagnum have not been static, but progressive. From time to time valuable suggestions as to where the pads could be improved have been received from surgeons at the front who have been actually using them. Acting on these suggestions, the British have gradually increased the efficiency of their moss dressings. More recently the American Red Cross, after some experimentation under the direction of Dr. John A. Hartwell, has adopted a different dressing which promises to be even more efficient than the one authorized by the British War Office. But the last word has not yet been said on sphagnum for surgical dressings. The American type of sphagnum dressing is composed of gauze, a thin sheet of wood pulp paper, non-absorbent cotton and sphagnum. The sizes of the dressings will vary from time to time as the War Department may recommend. The first half million pads allotted to the Northwest Division of the Red Cross consists of two sizes, 8 in. by 12 in. and 12 in. by 24 in.

In making one of these dressings, a piece of Zorbik or Scott tissue[4] of appropriate size is placed on the table and on it a wooden frame corresponding to the particular size to be made. The frame, which is about three quarters of an inch deep, is filled evenly with moss over which a thin layer of non-absorbent cotton is placed and then the frame removed. The margins of the tissue are then folded over the cotton and sphagnum. It is usually convenient to use spring clothes-pins to hold

[4] Zorbik or Scott tissue is a very thin wood-pulp paper used to envelop the sphagnum and prevents it from sifting out.

the ends in place, although this is not absolutely necessary. In order to keep the outside covering free from particles of moss it is best to remove this incomplete pad to another table where there is no moss. Here it may be finished by the same worker or by another. A piece of gauze of appropriate size is spread out on the table and the incomplete pad is placed in the center of it, with the non-absorbent cotton up. A thicker layer of cotton is then put over the pad, extending about a quarter of an inch beyond the edges. The gauze is folded over the pad so that the long fold is on the back, that is, on the side next the non-absorbent cotton.

The open ends are folded in "muff-wise," first folding the under side up over the tissue-envelope, then folding the upper side to correspond and adjusting the "muff-end" carefully. The pad is patted lightly to make sure the sphagnum is evenly distributed throughout and then passed through a clothes-wringer. If, when held up to a strong light, "holes" are detected in the pad, too little moss has been used. If the pad is solid and harsh, there is probably too much moss.

The British type of sphagnum pad consists of a flat bag made of English long cloth with a fine enough weave so that the particles of moss will not sift through. This bag, which varies in size according to the need, is filled with the appropriate amount of moss and sewn up.

The Canadian Red Cross adopted three types of sphagnum dressings, the British type just mentioned, a standard dressing similar to the American type and bed pads made of second grade sphagnum. During the summer (1918) the Canadians are concentrating most of their energy on the standard dressing, while a smaller number of the British type and comparatively few of the bed pads are being made.

SUMMARY

1. The use of sphagnum as a substitute for absorbent cotton is not only a great saving of money but is fast becoming an absolute necessity on account of the acute shortage of cotton, due, in part, to the extensive use in explosives.

2. It has been estimated that if absorbent cotton were used exclusively in the hospitals the cost would be not less than $200,000 per annum for Great Britain alone, while the cost of the moss is practically negligible.

3. The value of sphagnum as a surgical dressing lies chiefly in its absorbency. The species used for this work will absorb and hold fourteen to twenty times their weight of water. Ordinary absorbent cotton will hold only four or five times its weight.

4. The sphagnum is not subjected to any special treatment for surgical dressings but simply gathered from the bog, the foreign material removed, dried and made into pads which are sterilized after they get to France.

5. There is some indisposition on the part of American surgeons in France to use these pads. This is what was anticipated as surgeons are, to say the least, conservative in connection with their supplies, etc., and generally speaking indifferent as to the expense of these supplies. The British Army Medical Service went through the same thing two years ago and even up to last year sphagnum dressings were looked upon as an undesirable make-shift by a great many British surgeons; but at last they seem to have come into their own, as can perhaps best be illustrated by the fact that Canada has been given an allotment of 20,000,000 and that Scotland has been recently asked to turn out 4,000,000 sphagnum dressings a month.

6. Although sphagnum for surgical dressings has been largely the result of the present war, a make-shift for a necessity that had arisen, yet there seems every reason for believing that it is not going to be discarded after the war ends. The inexpensiveness of the moss, its high absorbency, its abundance in certain parts of the country and its undoubted superiority over gauze and absorbent cotton for some purposes, clearly indicated that it is too important as a hospital equipment to let die with the war. When the war is over it will probably take its place among the regular commercial products called for by modern hospitals.

7. The last word has not yet been said regarding sphagnum for surgical work. Ex-

periments are constantly going on, looking towards both the improvement in these dressings and also in the extension of the usefulness of sphagnum along other lines.

J. W. Hotson

The University of Washington,
Seattle, Wash.

A NEW SEASONAL PRECIPITATION FACTOR OF INTEREST TO GEOGRAPHERS AND AGRICULTURISTS

Most persons who have attempted to correlate soils and vegetation with atmospheric precipitation have directed their attention chiefly to the total annual rainfall and its variations from place to place.[1] It has long been recognized that seasonal distribution also needs to be taken into consideration, but there has been no unanimity as to how seasonal variations of rainfall should be treated. Some have simply mapped the total precipitation for each month or season separately, or indicated the months of maximum rainfall in different regions; but a more common method has been to map the percentage of the total occurring in the six middle months of the calendar year, April to September inclusive.[2] Such an arbitrary division is rather unscientific, however, for in the eastern United States, if not throughout the northern hemisphere, the warmer half of the year usually extends from the latter part of April to the latter part of October, so that May to October inclusive would more nearly represent it.[3] The use of the earlier period has been defended on the ground that April rain is more beneficial to crops than October rain, which is probably true (and so would March rain be better than September rain); but the type of rainfall that is best for crops, other things being equal, is not necessarily best for soil in the long run. A warm rain presumably has a greater leaching effect than cold rain or snow, and regions subject to heavy summer rains, like most of Florida, generally have poorer soils and more swamps than where the summers are dry, as in California.[4]

In recent years the writer has calculated the rainfall percentages for May to October and also for June to September for numerous stations in the southeastern states, and thereby shown some interesting correlations with soil and vegetation.[5] But when these factors are mapped for the whole United States the correlation does not work out so well. For the northern part of the Great Plains has about the same proportion of its total rain in summer as peninsular Florida, but very different soils and vegetation. Of course part of the difference is due to the fact that the total rainfall and average temperature are much less on the Plains than in Florida. But there is another important climatic difference.

In the Great Plains and much neighboring territory the bulk of the rain falls in early summer, while along the Atlantic and Gulf coasts there is generally more rain in late summer than in any other equal period. Consideration of this fact recently led to some comparisons between early and late summer rainfall for the whole United States. After some experimenting it was found that the most striking results were obtained by taking the difference between the rainfall for April to June inclusive and that for August to October inclusive,[6] the former being good for the

[1] For such correlations between soil and rainfall see Bulletin 3 of the U. S. Weather Bureau, by E. W. Hilgard, 1892. A review of this, which may be more accessible than the original, can be found in the *Experiment Station Record*, 4, 276–282, October, 1892.

[2] For a map of the United States on this principle see Plate 2 in U. S. Geological Survey Water Supply Paper 234, 1909.

[3] See *Geol. Surv. Ala. Monog.* 8, 24; *Bull. Torrey Bot. Club*, 40, 395, 1913.

[4] Dr. A. D. Hall, of Rothamsted, in an address on agricultural extension problems published in the *Popular Science Monthly* for October, 1914 (p. 349), says: "Winter rain is more valuable than summer."

[5] See *Bull. Torrey Bot. Club*, 37, 415–416; 40, 395; 41, 556–557; *Geol. Surv. Ala. Monog.* 8, 19 24, 36, 1913; *Fla. Geol. Surv. Ann. Rep.*, 6, 182–184, 1914; also Ward in *Bull. Am. Geog. Soc.*, 46, 47, January, 1914.

[6] If climatological data for fractions of months were available we could include the first half of July in the early summer period and the second