finds difficult to understand and to bear, and must some time learn how to prevent.

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THE NEED FOR ORGANIZATION OF AMERICAN BOTANISTS FOR MORE EFFECTIVE PROSECUTION OF WAR WORK[1]

OUR country is now passing through one of the most critical periods in its history and the manner in which we shall emerge from this turmoil will depend on how successfully we can apply a lesson now being taught us by our arch-enemy Germany—the value of organized effort. The central empires are surpassed by the allies in manpower and in economic resources of every kind. But Germany is a marvel of organization and she has so thoroughly coordinated all her activities, especially those relating to war, that she is able to throw every ounce of her power in any direction desired. On this account she absolutely dominates her allies, and to this she owes her military efficiency and her powers of endurance. The United States and the entente nations are rapidly learning this lesson and, although the daily press is filled with stories of inaction and of clashing authority and with reports of investigations of alleged incompetency, still we see everywhere about us the evidences of greater cooperation, of standardization in production and of more thorough organization of all our activities—signs which augur well for future victory, for it is only by beating Germany at her own game that we can hope to win this war quickly.

The increase of efficiency by organization is no new discovery of the Germans or of this time of war. The remarkable development of American industry has been due in a large measure to the capacity of our business men for organization. But Americans are independent beings and have feared the evils of excessive organization—the curbing of personal freedom and initiative, and the reduction of the individual to the level of a cog in a smoothly running machine. The evils arising from over-organization are probably more to be deplored than those due to under-organization. Neither extreme develops the highest type of human being nor makes for lasting human progress. But in these times of stress we must not hesitate—the necessity for more thorough organization in all lines is forced upon us, and botanists, together with other scientists, must heed the call. This is a scientific war and science, not brute-force, must win it. Scientific workers become individualistic, and pure research naturally shuns the publicity of organization, but many lines of research and applied science in general are as much benefited by cooperation as is any industry.

Nowhere is the need for organization greater than in connection with the food supply, the importance of whose problems has been pressed upon our attention by the prevailing high prices and by the shortage of sugar and other important food stuffs. The relation of botanists to food production is a vital one and as botanists we now carry a grave responsibility.

We also face a wonderful opportunity. In the past botany has failed to receive the full measure of popular appreciation it deserves, though no subject is more vitally connected with human welfare and human progress than the study of plants. Botany is one of the oldest of human studies, yet we have seen other sciences of smaller ac-

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tual value to mankind overtake and pass it in public esteem and in public support. Does not the fault lie with botanists themselves? Have they not been too prone to lose themselves in their scientific studies and to forget or to neglect their human responsibilities? Botanists have allowed subjects like bacteriology, agronomy and horticulture to struggle up largely unaided and to win independent status so that to-day many specialists in these fields of botanical work do not recognize themselves as botanists and yield no allegiance to the mother science. It is not so with chemistry. Every worker in the chemical field calls himself a chemist, no matter what his special line may be, and chemistry is written large in public esteem as a great and broad and practical science. On the other hand the average person has little conception of what botany really is, and of its practical value to mankind. We can not expect the federal and state governments to fully recognize the great value of botanists to the nation when botanists themselves are at a loss to know how they may best serve in this time of crisis, and when they have allowed almost a year of war to pass without taking a prominent professional part in war activities.

This period of national danger presents to botanists an unrivaled opportunity to win the full recognition our science now lacks, to win it for all time, and also to serve the nation and help win the war, by showing what botanical research and the application of botanical knowledge can do in solving the problems of increased food production. This is our special field and the problems presented to us are so varied that all divisions of botany must take part in the work.

Time is pressing and the emergency demands that we speed up in our output of accomplishment in lines of immediate value in the war. This means mobilization of our botanical forces so that all workers capable of rendering assistance may be utilized; it means organization under wise leadership that our efforts may be properly correlated and thus rendered most effective; it means concentration on the problems most immediately important and if necessary the laying aside for the moment of the particular lines of research which now chance to interest us, if by so doing we can serve our country more effectively. At this time when we are facing a serious depletion of our ranks due to the call of many of the younger botanists to military service, how essential it is that those of us who are left should see to it that botanical work is not disrupted, that personal and professional interests are laid aside if need be, and that our efforts are wisely coordinated and properly distributed. As an example of the type of cooperative service I believe we should undertake, I shall discuss this afternoon one phase of botanical work now being organized, which aims to assist in increasing the food production of the United States and which is marked by organized cooperation on a large scale.

Two imperative demands have been made on the American people this year in connection with the food supply. The first of these is—*raise more food, increase food production.* Dwellers in towns and cities were bidden to enlarge their gardens, and we have responded by spading up our back yards and by plowing vacant lots. There has been much poorly directed effort like that of the patriotic citizen of New Jersey who, after watching his neighbor use a crow bar to make holes for his bean poles, went home and made similar holes into which he dropped his beans and buried them for all time; yet altogether the back-yard gardens have materially increased our supply of vegetables. Farmers were

bidden to increase their acreage, and have done this, so far as they were able. But it is clear that if the food supply is to be increased it must be accomplished largely by increasing the yield per acre, rather than by increasing the acreage; and the botanists of America must largely assume this responsibility. The adaptation of crops to soils and to climate, proper crop rotation and general improvement of cultural methods, the development and introduction of better seed and of improved varieties, the checking of ravages of plant diseases—these and many others are botanical problems in the solution of which botanists of every type must have a share.

The second demand on the people this year in connection with the food supply is —*save food, prevent waste.* We find here the problems of the pantry and the kitchen, of storage and transportation, of the preservation of perishable crops and foods—problems many of which are botanical or have botanical aspects.

There are no richer fields of scientific research to-day than the varied economic problems now presented to the botanists of America, and none fraught with greater possibilities of honor to the worker and of benefit to the nation, and to no class of botanists is the call stronger or the duty greater than to the plant pathologist. By preventing the ravages of diseases on growing crops he increases food production, and by checking the development of the organisms of decay on food material in transit and in storage he prevents food wastage. We are now saving food to feed our allies by instituting wheatless days and meatless days, and days and meals less this and that. Under present conditions this procedure is necessary and the curbing of our appetites has its hygienic value. But how much more pleasant it is to save food by curbing plant diseases, which can and should be done much more extensively than is now the case.

I shall not attempt to demonstrate the importance of the work before pathologists by citing figures giving estimates of losses due to plant diseases. I will only remind you that there is no economic plant which has not its fungous enemies, each of which takes its toll of the growing crop, while many plants count these enemies by the dozen or the score, so that the total aggregate loss is staggering. But the consumer does not appreciate this fact, and even the grower himself is indifferent. Both are so accustomed to a certain amount of loss from disease and storage rot that they accept it as a matter of course, not realizing that much of the loss is easily preventable. Since the symptoms of disease in plants are ordinarily much less striking than those of disease in animals, or even than the ravages of the crops by insects, the average farmer may not recognize the presence of disease in his grain field until the loss amounts to 15 or 20 per cent.; less than that is overlooked or charged to the weather. It may require the loss of a third to half his crop to arouse him to action and to the adoption of proper control measures.

So we see that the plant pathologist has a double duty to perform. He must first devise means for controlling plant diseases; he must then carry these control measures to the farmers and arouse sufficient public interest to secure their regular and effective adoption. The second of these functions is no less important than the first, and frequently is much more difficult of accomplishment. The scientific aspects of the problem may be solved when the pathologists have devised effective means of control, but the economic aspects are not solved until the disease in question is conquered and the losses reduced to a negligible amount by the general adoption of control measures by the growers.

Plant pathology has had a magnificent development during the last 20 years, and yet only a beginning has been made. As yet there are few if any plant diseases which we can say have been conquered and practically eliminated from consideration as the cause of any considerable economic losses. There is no record that any plant disease, after having once thoroughly established itself over a considerable territory, has ever been eradicated. Nor is there any plant disease which is to-day being effectively controlled in practise except in limited areas, no matter how simple or how effective the control measures are. Remedial measures are known for many diseases, and there are many whose complete control is easily possible, but the public has never been aroused to the necessity of thorough and persistent application of the remedies. Pathologists have not completed their work. We need more propaganda to instruct and to arouse sentiment in favor of disease control. We need public control of plant sanitation, as we have a public health service for human beings. We need laws requiring treatment of grain for smut as we now have laws requiring smallpox vaccination. At this time when the world is hungry, the producer of food has no more right to jeopardize or to neglect the health of his crop than you or I to endanger the public health. And the plant pathologist, as the guardian of the health of food crops, should rank in importance with the medical practitioner and the public health officer. We have come to the time when plant pathology should be carefully reorganized as a public service and when pathologists should scrutinize all phases of their work and see to it that no important part is neglected. The need for this action has been increased by the world war but it would have become necessary soon had the world remained at peace.

In glancing over the history of plant pathology we see that the first phase of the subject to develop was research work on the diseases—study of the life histories of the causal organisms, and of their relations to and effects upon the host plants. Perhaps control measures were also worked out, but with the publication of his paper the investigator dropped the subject without making sure that the results of his investigation were carried to the grower. Much valuable work of this character has been severely criticized as being impractical, some critics even now going so far as to urge that research work be suspended entirely for a time and attention concentrated on the practical application of present knowledge.

More recently there has developed a second phase of phytopathological work, *i. e.*, extension work or the actual carrying of the results of investigation to the farmer, and the practical demonstration to him of control methods, thus bridging the gap between investigator and grower. Great progress has already been made in this field and plans are now maturing for still further development. This is a line of work of the greatest importance, which should be specially pushed at this time in order that the ravages of disease may be effectively checked in those cases where adequate control measures are already known.

There remains a third phase of pathological work, which we may call the intelligence service, which is fundamental in importance and is contributory to the success of both research and extension work. A well-organized intelligence service is a necessary adjunct to every large enterprise. Armies have their scouts and spies, their raiding parties on land and aeroplanes in the air, to keep the commanders informed of the movements and plans of the enemy. Great business houses have their domestic

and foreign representatives and correspondents. Governments have their consuls, attaches and secret service. Human medicine has its public health service to guard the public health, to report on disease and to attend to sanitation. In the same way plant pathology needs its intelligence service, its public-health service for plants, which shall assist both research and extension pathologists in waging war on plant parasites.

The Plant Disease Survey of the Department of Agriculture is now organizing such a service, and I believe that it will prove to be of great value. By accumulating a large body of authoritative information on the geographical distribution and annual prevalence of plant diseases, together with careful estimates of the losses caused by them we shall assist in clarifying the disease situation in the various parts of the United States and in delimiting the problems involved. With these data at hand pathologists will be enabled to choose their research problems wisely and to concentrate their energies on those questions which are most pressing in their respective states. The Plant Disease Survey will also aid the research pathologist by furnishing him the information he needs during the progress of his studies, such as data on the nature and character of diseases in the field and on the relation of diseases to climatic and other environmental factors. We shall also assist the extension pathologist by informing him of the prevalence of diseases, of regions where losses occur and where demonstration work is most needed, of the varying effects of control measures in different regions, and of other matters of importance in planning and carrying on his campaigns of education and of disease control.

Up to this time the gathering of field data on plant disease has been left to the individual investigators who have gone into the field during the progress of their studies to collect the information they needed. They have thus been called away from the main features of their problems in order to collect data which should more properly be furnished them. Extensive collection of field data by an investigator beyond the time needed to keep him in touch with all phases of his problem, is time lost. He frequently realizes this and reduces his field work to a minimum, thus handicapping himself in his research work by an insufficient body of field data.

I shall not attempt at this time to discuss in detail the plans of the Plant Disease Survey. We purpose to organize this work on a broad basis, to coordinate all existing efforts along this line, to systematize the collecting of information and to make all data thus gathered immediately available to all to whom it may be of value. We have already associated with us as collaborators and local leaders the pathologists at almost all the state experiment stations, and we hope to extend this system of cooperation until we shall include in our organization all pathologists and all others able and willing to contribute reliable information on plant diseases. We also hope to develop and to maintain in the field a corps of trained observers who will supplement the reports of our correspondents and make detailed surveys in special regions and for important diseases. Much work must be done before our plans are fully developed. This will require time, general assistance on the part of botanists, and larger funds than are yet available.

Let me emphasize the fact that the Plant Disease Survey is distinctly a cooperative project. It is not an end in itself but aims to serve all pathological workers of the country by freely supplying all available data which can aid them in their work.

The success of this movement will depend on the extent to which pathologists cooperate in contributing to the common store of information. No matter how absorbing your present work may be each one of you as a botanist can aid us by reporting on the disease situation in your immediate neighborhood. This report may be made to our collaborator, the pathologist at your state experiment station or if preferred it may be sent direct to the central office of the survey at Washington. We shall be glad to discuss with you individually the best means of making your cooperation effective. Not only will the information you send us be of value, but your active support will assist us in our efforts to unite all pathological workers in one great cooperative service which will strive to do for our food crops some of the things which the public-health service does for us as human beings.

In this paper I have endeavored to point out the grave responsibility which rests on us as botanists during this world war. This responsibility is a challenge to us as patriotic Americans because we possess special knowledge and training which the nation needs, and to which she has a right during her hour of peril. I have emphasized the growing need for cooperation as with added responsibilities and reduced numbers we strive to meet the increasing demands of the immediate future. I have presented to you as an example of such cooperative effort the work of the Plant Disease Survey and have urged you to join us in our plans for strengthening phytopathological work. In closing let me outline two movements of fundamental importance which I believe botanists should immediately undertake.

First, let us arouse the public to an appreciation of the important part which botany must play in the agriculture of the future. Increased acreage and improved facilities for distribution of farm products are not sufficient to ensure the world an adequate food supply. Increased production must be the result of scientific research, and the average farmer must be taught the value of the prompt application of the results of research to the improvement of agricultural methods. And not only must the farmer be educated but propaganda must be carried on with the business man and the legislator that the botanist may be properly appreciated and his work supported. Botanical work, even of the most fundamental importance, is apt to lack those striking or sensational qualities which chain public attention, and unaided draw large appropriations from our lawmakers. Let us then teach our students the human significance of the study of plants, and send them forth as missionaries. Let us by spoken and printed word and by demonstration strive to instill into the public mind a greater respect for botanical research and a more ready acceptance of its results, thus doing our bit toward ensuring both scientific and material prosperity in the future.

And second, let us immediately organize to increase our efficiency. A serious crisis requires that maximum power be exerted to avoid catastrophe. Hence discipline and organization under aggressive leadership must replace independent uncorrelated effort. I propose therefore that the Botanical Society of America, the American Phytopathological and other botanical societies now in session at Pittsburgh appoint committees of experts in the various botanical fields to effect the necessary organization and to provide the leadership required. These committees shall consider the relative importance of the problems falling in their respective fields, whether or not those problems are now under investigation.

They shall mobilize the available botanical forces of the United States, especially those workers who are now engaged in war emergency work, and by careful distribution of the work and by correlation of effort seek the early solution of those problems which are of greatest immediate significance. The support which any movement receives and its effectiveness depends largely upon its leaders, hence these committees must be wisely selected and composed of aggressive men of action whose wisdom and personality will command the allegiance of their fellow botanists.

Many may doubt the wisdom of the plan I have suggested and feel skeptical of the results to be obtained through committees. I do not care what plan is adopted—the essential thing is action. No one can longer doubt the seriousness of the path which lies before this nation or question the imperative need for the greatest service botanists can render. American manhood is preparing to suffer and die upon the battlefields of Europe, and we who stay at home must not fall one inch short of the greatest accomplishment of which we are capable in providing the food and supplies our soldiers need. Any failure on our part means prolonging and intensifying the frightful agony. Have we thus far done our best as botanists? Are all botanists working with the single purpose of doing their full duty in this war? Does not unpreparedness still characterize us as a class? Have we not in general continued our pre-war activities, thinking the war would soon be over, or waiting for some mighty call to draft us into service? Let us wait no longer, but call *ourselves* to service. There is time to prepare for an effective campaign during 1918; there are many botanical questions of paramount national importance which should be solved this coming year; and there are many botanists who have assured me that they will gladly turn aside from their present work if they can serve more effectively elsewhere. Let us organize for more effective service that we may attract all available workers to our ranks and enlist every botanist in war emergency work. Let us develop a logical and comprehensive plan of campaign which shall supplement the plans of federal and state departments of agriculture and receive the united support of American botanists. Let us wisely correlate our efforts that we may increase our immediate accomplishment and make of American botanists a powerful army of trained scientists moving forward with power and precision in the service of the nation and the world.

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SCIENTIFIC EVENTS

ENGLISH VITAL STATISTICS

THE Registrar-General's return of vital statistics for 1916 in England and Wales, according to an abstract in the London *Times*, shows a reduction of 4.5 in the marriage rate as compared with that for 1915, when it was exceptionally high, and the lowest death-rate of children under one year ever recorded.

The report refers to the difficulties of framing estimates of population owing to the war. These have become so formidable that it is no longer possible to put forward figures otherwise than as rough approximations. As the estimates (except those for birthrate and marriage-rate purposes) are for the civil population only, enlistment has been treated as equivalent to emigration. The estimated civil population of England and Wales was 34,000,000 in 1916 (15,000,000 males and 19.000,000 females).

The marriages during 1916 numbered 279,846, a rate of 14.9 persons married per 1,000, 0.6 below the average rate of the decade 1901-10. The marriage rates for 1916 were 49.6 for males and 41.0 for females, the lowest hitherto