In the day time 57 eruptions occurred between 7 and 11 A.M., 40 occurred about noon, between 11 A.M. and 3 P.M., while between 3 and 7 P.M. 46 occurred. It has been supposed that a greater supply of surface water might favor eruption. If that is true, we should expect more frequent eruptions in the late afternoon or early evening when the day's supply of water from melting snow is at its maximum. On the contrary, the mornings have most eruptions, at a time when the daily heat and water supply are near their minimum.

That the volcanic energy is not dependent upon the supply of surface water to form steam is suggested by the fact that summer and autumn, the dry season, with least water, have a greater number (94) of eruptions than (84) the wet season of winter and spring.

In order to determine whether the volcano responds to the tidal wave produced in the crust of the earth by the moon, Mr. Van Orstrand has carefully considered 190 of the best recorded eruptions and concludes that as yet the results are merely suggestive.

If we compare the number of corresponding seasonal eruptions in 1914 and 1915 the result appears significant. In the summer of 1914 there were 38 eruptions, but in 1915 only 17. In the autumn of 1914 there were 56 eruptions, while in 1915 there were only 22. Since the great eruption of May 22, 1915, when the new lava was extruded and the Hat Creek country devastated, the number of eruptions has decreased and the decadence continues, but whether or not the active period of Lassen Peak is approaching its close, although probable, may be more certainly told next summer.

With its comfortably active volcano, inviting cinder cones and lava fields, vigorously boiling hot springs, mud lakes and "mush pots" for the vulcanologist to study, and the glaciated divides and canyons for the physiographer, in a setting of lovely scenery and attractive camps, for the tourists all easily accessible, the Lassen Peak region affords one of the most alluring and instructive spots for a national park.

J. S. DILLER

U. S. GEOLOGICAL SURVEY,
WASHINGTON, D. C.,
April 18, 1916

THE NEED FOR MORE HORTICULTURAL RESEARCH[1]

IN order to introduce my subject I hope I may be pardoned for digressing a moment. A few years ago while spending a part of a vacation in the Sierras, I climbed from the floor of Yosemite valley to the top of Glacier Point. To those of you who have been there I need not say that this climb required several hours of very severe physical effort. In traveling a mile and a half or less, the vertical ascent amounted to three thousand feet. I was accompanied by my wife, and being mindful of her safety as well as my own, I very naturally chose each step of the climb with great care. Often a contemplated step might look safe enough but, on glancing into the depths below, I would feel the necessity for making a more careful examination of the footing before risking my weight upon it. There were numerous instances when a false step might have sent us both hurtling downward, and it really is not pleasant to contemplate a half-mile drop into space even when accompanied by good company. Sometimes what appeared to be firm soil on a ledge turned out to be sand, or what looked like solid rock proved to be loose stones concealed by moss and lichens. Thus the journey was made without mishap, but slowly, tediously, because

[1] President's address delivered before the twelfth annual meeting of the Society for Horticultural Science, Columbus, Ohio, December 28, 1915.

every step had to be proved before the next one could be made.

Now this little experience in mountain climbing is not unlike that of a man who undertakes to write a bulletin, scientific paper or even to prepare a lecture to deliver in the classroom. Every member of this society has to do some or all of these things every year. And I ask you how often you have tried to make the points of your discussion safe and unassailable by proving every step you took. Take almost any subject in horticulture, no matter how commonplace, and how far can you proceed with your task if you try to make all of your statements square with proven facts? Don't you find that every few steps you discover, upon close examination, that what looks to be firm ground turns out to be loose sand and rolling stones? Facts are usually things that have been experimentally proven. Many of the accepted facts of horticulture—statements that are repeated over and over because others have used them, until they have found their way into respectable literature—too often turn out, when subjected to the acid test of careful inquiry, to be mere theories or opinions.

Granting that many of the things we give our students every day as facts are really truths that have been learned by long experience or general observation, I ask if it is not high time that we cultivate the habit of proving our statements by submitting the evidence. But, you object, we would never be able to get anywhere in a discussion—that it is out of the question to try to prove everything we say. And unfortunately this is too true, which brings me to the real subject of my remarks, viz., the great, I might almost say, the crying need, for more horticultural research.

I am using the word research here in a very broad sense, so that it may include all kinds of experimental work. Correctly speaking, an experiment is an act or operation designed to discover, test or illustrate some truth, particularly by arranging the elements or essential features of some object or process so as to permit of controlled observation, as variety tests of fruits and vegetables, pruning tests of trees or fertilizer tests with growing plants. Research, on the other hand, is diligent, protracted investigation for the purpose of adding to human knowledge. The ultimate aim of real research is the discovery of natural laws and fundamental truths. Research may, and probably will, include many experimental tests, but the aims of an investigator should reach much farther than the bare results of any tests. The experiments may be regarded as mere steps in an investigation. There appears to be a widespread belief that research means something impractical, that it can seldom or never be engaged in with direct profit to a state. Even some station directors—though happily they are in the minority—seem to hold this view.

I do not for a moment underestimate the value of experimental work. Every horticultural department should have as many experimental projects as can be handled. In this way many theories can be tested and a very great many practical questions answered. Still, some dangers may lie concealed along the experimental way, for in the very nature of things there are questions and problems that can not be answered or solved by experimentation alone. Perhaps the chief danger is the predilection for drawing unwarranted conclusions from simple tests. Also students and very young station men may be misled into believing that they are investigating when they are only experimenting, and this may be fatal to their potential future usefulness.

I can not refrain from prolonging this part of the discussion by saying that investigational work may be the most practical kind of activity that men may engage in. To cite a field of inquiry in which I may claim more or less acquaintance, I may say that the problem of the rest period of plants—while an investigation seeming on its face to serve no practical purpose, has already been found to shed light on the very live and very practical question of hardiness of fruits in cold climates. And in warm climates, particularly under semi-arid conditions, I am convinced that it will eventually serve as a foundation stone on which to establish irrigation and pruning practises as applied to deciduous fruit trees. Both pomological and irrigation divisions are now carrying on experiments, independently and cooperatively, to determine these things, but I greatly fear that all present efforts are only scratching the surface of the one great question of orchard fruitfulness.

But I have wandered away from my subject as I had meant to discuss it. What I started out to say was that we need more facts pertaining to horticultural questions. Not only should more problems be investigated in an experimental way, but whenever a piece of work is carried out, no matter how small it may be, should we not bend every energy toward establishing each and every step so securely that all will endure the wear and tear of the multitude of other workers who may desire to climb toward other things over the secure stones that we have laid? Let us not despise experiments with commonplace things just because others have been content to pass them by on the strength of current statements (unsupported by experimental proof of any kind) which say that it is best—yea even vitally necessary—to do thus and so, if certain results are to be attained.

I wish I had time to submit a full list of the common things teachers of horticulture have to discuss without being able to offer evidence that would pass muster in a justice's court. However, I shall have to be content with a few random shots that occur to me on the spur of the moment: In graftage what is meant by an uncongenial stock or lack of affinity between scion and stock? What happens when a bud with its adhering piece of bark is inserted beneath the bark of a stock? Does each part possess a complete cambium layer or each only half a layer? In healing wounds how are two outer bark surfaces, upon meeting, enabled to grow together? What relation does callusing bear to root formation in cuttings? Where can we find some reliable quantitative comparisons of tops and root systems of fruit trees? How does branch pruning affect the root system of trees? Is there a corresponding root for each vigorous new water sprout? What do we really know about the secret of fruitfulness in trees, particularly the fruiting habit? Why do so many apple trees bear on alternate years? Why can not Ben Davis and Baldwin, for example, be made to bear annually? Why is it an apple tree may bear fruit buds enough for a "full" bloom and only ten per cent. really open in spring? What is the true effect of sunlight on fruit bud formation? What are the causes of growth periodicity in trees and the relation of same, if any, to fruit-bud formation? What is "hardiness" in trees and buds? What is the nature and cause of coloring in apples? What do we know about the value of selecting buds in deciduous trees? Is "pedigree" in trees a humbug? Why do certain individual trees appear to have a superior record for fruitfulness? What is meant by vigor in trees? What is the true cause of "June drop" in fruit trees? And so on and so on; all of which makes us painfully

aware of the fact that there are a world of things appertaining to common practises which we know little about. But this lack of knowledge should not discourage us, as was the case of the fond parent in the story who put his son through a seven years' medical college course and then was thoroughly disgusted because the young man couldn't tell him how to cure a wart.

On the other hand, we should be stimulated to greater effort in seeking out facts for ourselves and we should not ignore too many of the little things just because they may seem commonplace. If a young man wants a problem he need not look far to find one. But let us get away from stereotyped statements and try to acquire a new stock of first-hand information.

Somehow or other our horticultural literature has gradually become permeated with dogmatic statements and unsupported opinions which our students are permitted to absorb as gospel truths. Who is to blame for this I can not say and I fear it would not be profitable to try to place the blame. Conditions are probably responsible for the most part in bringing about this state of affairs. For horticulture is one of the oldest of the agricultural groups recognized by the colleges and stations. Without any experimental facts at their disposal and with few or no facilities for securing experimental information, men were called upon to give instruction in fruit-growing and gardening and they met the situation as best they could by drawing upon their own practical experience or the experience of horticultural friends and did their best to explain why certain things had to be done so and so, even though it sometimes became necessary to draw heavily upon their imagination. But, in the language of the day, they "got away with it" and some of us have continued, more or less, to keep up the practise.

Reform, however, is coming about and coming from a source least expected, viz., from the students that we have to teach. With the rapid raising of standards for entrance in the agricultural colleges, came a class of students with good fundamental training who refused to accept the time-honored statements so general in horticulture without at least plausible explanations. I feel certain that this has been the chief force that has broken the old traditions and is bringing about a brand-new horticulture. I am sure a brighter day is dawning and that we shall soon be free from all the hampering fetters of the past.

One reason for my cheerfulness regarding the horticultural situation is the result of an inquiry which I recently addressed to all the experiment stations in the United States. Since there is somewhat of a scarcity of reliable horticultural literature along many lines, I greatly feared that administrative officials might be placing better facilities at the disposal of their departments of chemistry, botany, etc., but I find that apparently such is not the case. My findings show that approximately half of the stations of the United States have one or more officials in horticulture designated as research men, but that eighteen per cent. of these persons do some teaching. However, I did not learn the nature of this teaching. If it is a limited amount of graduate or upper class instruction the men will be all the better investigators, but with too much lower class work their research titles may become a farce. Station directors often reported men as doing no teaching while the men themselves said that under stress of circumstances they were compelled to do a considerable amount of teaching. Deans and directors are sometimes great "boosters." From incomplete replies representing thirty or thirty-five institutions, it appears that horticulture is fully as well represented by

research men as other departments of the stations.

An effort was made to find if the output of horticultural bulletins is as great as from other departments, but this part of the inquiry was a failure. Of the nearly 200 "official" horticultural projects now under way in the various stations, about eleven per cent. are Adams Fund investigations and over thirty per cent. of the others are regarded as being of research grade.

In conclusion I may add that it appears that the whole range of horticulture from floriculture to pomology now seems to be as well manned as other departments, and if the next few years does not see a greatly increased output of reliable literature, then we are not living up to our opportunities.

W. L. HOWARD

UNIVERSITY FARM,
DAVIS, CAL.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

REPORT OF THE TREASURER, 1914

IN compliance with Article 15 of the Constitution, and by direction of the Council, I have the honor to submit the following report, showing receipts, disbursements and disposition of funds of the association for the year ending December 31, 1914.

Receipts have come into the keeping of the treasurer from one source, namely, interest on funds deposited in savings banks. The total amount of this interest is $935.49.

Disbursements made in accordance with the direction of the council amount in the aggregate to $448.67.

The total amount of funds of the association deposited in banks and subject to the order of the treasurer December 31, 1914, is $30,138.20.

The details of receipts, disbursements and disposition of funds are shown in the following itemized statement.

R. S. WOODWARD,
Treasurer

April 1, 1914

The Treasurer in Account with the American Association for the Advancement of Science

DR.

1914		
Jan. 1.		
To balance from last account		$29,651.38
To interest on funds in banks as follows:		
Cambridge Savings Bank, Cambridge, Mass.	$46.41	
Emigrant Industrial Savings Bank, New York, N. Y.	120.00	
Metropolitan Savings Bank, New York, N. Y.	105.00	
Union Square Savings Bank, New York, N. Y.	105.00	
U. S. Trust Co., New York, N. Y.	499.68	
Munsey Trust Co., Washington, D. C.	59.40	935.49
Total		$30,586.87

CR.

1914.		
Dec. 3.		
By interest paid on 252 life memberships		$398.67
Dec. 4.		
By one life membership under Jane M. Smith Fund		50.00
By cash in banks as follows:		
Cambridge Savings Bank, Cambridge, Mass.	$1,066.81	
Emigrant Industrial Savings Bank, New York, N. Y.	3,120.00	
Metropolitan Savings Bank, New York, N. Y.	3,105.00	
Union Square Savings Bank, New York, N. Y.	3,105.00	
U. S. Trust Co., New York, N. Y.	19,613.78	
Fifth Avenue Bank of New York, N. Y.	127.61	30,138.20
Total		$30.586.87

I hereby certify that the foregoing account is correctly cast and properly vouched.

HERBERT A. GILL,
Auditor

1915

In compliance with Article 15 of the constitution, and by direction of the council, I have the honor to submit the following report showing receipts, disbursements and disposition of funds of the association for the year ending December 31, 1915.

Receipts have come into the keeping of the treasurer from two sources, namely, from life membership commutations and from interest on invested funds. The total amount of these receipts is $1,403.14.