the continent, especially during the winter months.[2] Typhoons, the chief object of the forecaster's solicitude in the Far East, reach China from the eastward, after traversing a region that is now fairly well under observation; but even these depressions must be largely conditioned, in their intensity, direction, and rate of progress, by fluctuations in the pressure to the west of the present field of observation.

WHAT IS RESEARCH?

The following excellent remarks, by the editor of the Experiment Station Record,[1] apply so well to meteorology that we take the liberty of quoting them, and inviting our readers to give us their own ideas as to what constitutes research.

The outlining of plans for agricultural work under the Adams act has led to greater consideration of what should be regarded as research in agriculture. The terms "research" and "investigation" have been used freely in reference to experiment station work, and often more broadly than they are employed in science generally. We have fallen into the habit of speaking of much of the work as investigation, which in a strict sense can not be regarded as of that grade. * * *

There are several reasons which contribute to this uncertainty in the use of terms. Agriculture is a new science. Our knowledge is not as well systematized and classified, and the problems for research are not so definitely outlined as they are in the older sciences. Being a composite science, it has been built up on the basis of the pure and natural sciences. It has drawn upon these for many facts, which have been given a scientific or a practical application in agriculture. Important as this application may be, it is not always to be regarded as research or scientific discovery. * * *

Again, the needs of agricultural practise have frequently blinded station workers, and led them to mistake for investigation, tests and demonstrations or simple experiments involving no original features, but which led to an answer to the farmer's question. They have been flooded with practical questions, and have set out to answer these questions in the most direct and quickest way. * * *

Hence it is that much of our experimental work has given results which are largely empirical. We find that if we follow a certain program of operations we will get a given result quite constantly. * * * The experimenter often sees only the final result, and is satisfied with this if it is favorable. The investigator will strive to determine the cause of what he sees and the broader bearings of the results of his experiments. This will stimulate him to make investigations into these problems which will go down to the fundamental facts and enable him to prove his proposition step by step.

These differences in the use of terms, which have grown up as a result of circumstances and environment, make it desirable that we should discriminate carefully and intelligently in applying the funds under a new act which restricts them to investigation. * * *

For example, there was much experimenting upon the use of lime for land. Applications to some soils gave beneficial results, while on others there appeared to be no benefit, and it was thought by some to exhaust the soil and to be ill advised. A few years ago this represented the status of knowledge and experimentation. The results and the practise were entirely empirical. The lime was usually not needed by the crops themselves, although it benefited them, but the purpose it served was not known, and there was no way of reasoning whether or not in a particular case lime would be helpful or its use advisable. Soil tests were relied upon for this purpose, and while they might be regarded as experiments, yet in themselves they did not comprise an investigation.

There were research problems which experience and these experiments had suggested, and after a while these problems became the subject of investigation. The effect of lime in correcting an acid condition of the soil was observed; the relations of this changed reaction to the biological factors of the soil were worked out; and gradually from these and other facts a basis was formed for the philosophy of liming. Through research the knowledge of this common practise had been made "accurate and precise", and this accuracy and precision had been "translated into action". * * *

In feeding work the case is often on much the same plane. For example, we make a comparison of wheat bran and gluten meal for milk production. One of these feeds gives the better result, as measured by the yield and the financial returns, but often the inquiry stops there. * * * The real physiological relation of these feeds, or of their respective constituents, to the elaboration of milk remains untouched by such experiments.

Suppose, again, we feed a lot of steers on heavy rations of corn for fattening. Humanity says: "Shelter them in a warm, comfortable barn". They appear after a little to resent this. They are uncomfortable, and it is difficult to keep them up to the high rations. Divide them into two lots, and turn one out into the cold with only a shed to shelter them from the winter winds. The latter lot does better—is more thrifty, eats better, and makes better gains. Is the question answered? Too often it stops here. We have the empirical result, but it is supported by no reason.

Put one of these heavily fed steers into a respiration calorimeter and we find he gives off heat enough under his heavy corn feeding to keep his body warm without artificial protection. The reason has been found. Again, knowledge of common things has been made accurate and precise, and may be translated into action. * * *

Research is worthy of the name only as it sets up definite ideals or aims which it strives to attain by scientific methods of procedure. This will involve a definite plan of operations, a thorough consideration of what is known of the subject and its bearings, both practical and scientific, and should lead the experimenter to learn something of the reasons for the results he secures. While the aim should remain fixed, the plan will often have to be modified in detail as the investigation progresses. But too often there appears to be lacking any well-thought-out plan or object; this is developed piecemeal and lacks in directness.

There are certain operations which will always be more or less experimental, as they will depend upon a variety of conditions, either indefinite in extent or combined in such a way as to make the outcome somewhat uncertain. Such operations can not proceed with mechanical exactness, and this very element of uncertainty will lend a charm to the work. But the object to be attained and the line of experiment should be matters of mature consideration. An investigation should presuppose this preliminary.

The line of demarcation between investigation and the lower grades of inquiry is not always clear and sharp, but the character of the problem does not determine this. The lowliest and the most common subject may be a proper matter for real investigation. It is the man in charge of the work and his mental attitude toward it which determines whether it shall be a simple test, a conclusive experiment, or a thorough investigation. If he has none of the scientific spirit or sees only the purely practical phase, his work will stop with comparisons and simple experiments; but if he has the true spirit of the investigator and is trained to observe, even though he may not have seen a college classroom, his results will contribute something toward establishing a scientific fact.

We have been accused in our experimental [agricultural] work of having the immediately practical results too constantly in mind. The immediately practical work is important and desirable. It has helped to make the American stations strong in the confidence of their constituents. It should be continued and the results carried to the farmer in demonstrations, cooperative experiments, and other popular ways. But it is equally important to get at the scientific facts, which have a wider and more permanent application. Surely there is no conflict between such investigation and the securing of practical results.

[2] The relative number of storms reaching the China coast from the eastward and the westward is shown by the following statistics for the six years 1893–1898, as given by Father Froc in his "Atmosphere in the Far East during the six cold months" and "Atmosphere in the Far East during the six warm months." (Shanghai Meteorological Society. Seventh and eighth annual reports.)

	October.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	September.	Total.
Typhoons	21	9	4	0	0	2	2	7	10	27	15	18	115
Continental storms	13	23	26	23	27	34	32	29	20	8	5	9	249

[1] Issue for June, 1906, pp. 929–933.

THE INTERNATIONAL SEISMOLOGICAL ASSOCIATION.

The United States of America, through the Secretary of State, lately indicated its willingness to take part in the above-mentioned international association for the study of the large earthquakes of the globe. This association has its central bureau at Strassburg, Germany, Professor Doctor G. Gerland being the director, and he submits the following circular for republication in the MONTHLY WEATHER REVIEW:

The Central Bureau of the International Seismological Association, founded in 1903 by the Second Seismological Conference, which met in Strassburg, is now completely organized and in full activity.

The central bureau is located in Strassburg (Alsace), Schwarzwaldstrasse 10; the undersigned has the honor to be its director; the personnel consists of two assistants, one mechanist, and one servant. The workrooms are on the second floor of the building, the first story being occupied by the Imperial German Central Station for Earthquake Investigation.

The Observatory of the Central Station, which is located near the Bureau, is furnished with the following instruments: (1) a Rebeur-Ehlert triple horizontal pendulum with photographic register; (2) a two component Rebeur pendulum with photographic register; (3) a Milne