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A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

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THE WEEK'S PROGRESS in the preparation for the world's fair in this city in 1892 shows mainly, as is to be expected, in the recommendation, by various commercial and industrial bodies, of persons whom they wish to represent them on the committee of one hundred which the mayor proposes to appoint. So far, no action has been taken by scientific men toward giving suggestions as to the features of the exposition in which they would care to take part; and, while naturally scientific interests are not as keen as those which give the main impulse to the undertaking, it is desirable that the scientific men of the country should be heard from; and we cordially invite a free discussion in the columns of *Science* of the ways by which the interests of American scientific men may be served best by the exhibition. An accompaniment of every exhibition is a series of scientific congresses. To be sure, such congresses to the number of nearly a hundred will have been held in Paris before the close of the summer; but all questions will not be settled by them, and by the summer of 1892 the scientific men of the world will be ready for further debate.

At the present stage of affairs the discussion of the site is going on vigorously, Governor's Island finding a good many advocates. When there was talk of a world's fair eleven years ago, the witty editor of the then flourishing *Appletons' Journal*, Mr. O. B. Bunce, urged Governor's Island as a site in the following terms: "This island is one of the general government military centres, but we may assume that Congress or the executive, wherever the power lies, would promptly surrender it for the purpose proposed. The situation is superb. It is nearly at the junction of the Hudson and East Rivers, less than a mile from the Battery, and is equidistant from Brooklyn and New York. It lies directly upon the channel which leads to the sea; is fanned by breezes from the ocean and rivers; is healthful, salubrious, and every way charming. Ships from abroad could land their cargoes for the exhibition at the doors of the structures without a foot of land-carriage. Boats down the Hudson, boats from the East through the Sound, steamers from Southern ports, and lighters from the great railroad-depots at Jersey City, could do the same. A ferry would have to be established at the Battery, where are the termini of the elevated railways, which reach through the city to its uppermost limits, thus giving easy and convenient access from every point; while with ferry-boats in addition at points along each river, at Brooklyn, and at Jersey City, the great crowd of visitors could be gathered and dispersed with so little friction and so much comfort as to make this world's fair memorable compared with all others. Those who recollect the fatigue and torment of getting to and from the Philadelphia exhibition must welcome this feature of the prospect with delight; and in all of the exhibitions, so far, the journeyings to and fro have been fatiguing and tedious to a degree almost to overweigh the pleasure derived from the wonders on display. Governor's Island is between sixty and seventy acres in extent, and, as the area of the Philadelphia buildings is over fifty acres, the place may at first thought seem too small. This difficulty can be met by having galleries in the buildings, as was the case in the first Crystal Palace, and by erecting some of the structures over the beach supported by piles. Superb façades could be constructed at the water's edge, facing the harbor and the city, presenting a grand picture to the approaching visitors."

In a recent communication to the *Evening Post*, Mr. Bunce states that the island is a mile and a quarter in circumference, its shape being elliptical. A building encircling the island at the water's edge (which might rest partly on sea-walls) would be of greater length than the united length of the buildings at the Centennial Exhibition, the dimensions of which were as follows: main building, 1,876 feet; machinery hall, 1,402 feet; art gallery, 365 feet; horticultural hall, 383 feet; agricultural hall, 820 feet; making a total of 4,846 feet, with an average width of about 350 feet. A structure encircling the island 400 feet in width would exceed the capacity of the Philadelphia structures fully fifty per cent, and leave the greater part of the island free for the erection of special buildings by the States or otherwise. Whether the form of building here suggested would be adopted is not yet to be decided, but the figures show that there is considerable room on the island, and engineers might be depended on for a few annexed strips out over the water if need should be. The exhibition is to be held, unless all signs fail; it is to be held in New York as the great commercial centre, made so by its being the most accessible city in the United States; and we now urge on scientific men to take such action as will give due prominence to what they are doing for the world's advancement.

THE WHAT AND WHY OF AGRICULTURAL EXPERIMENT STATIONS.

PROFESSOR W. O. ATWATER, director of the Office of Experiment Stations, of the United States Department of Agriculture, has issued Farmers' Bulletin No. 1 of that office, containing a brief statement of the history, work, and aims of the agricultural experiment stations.

This bulletin is intended as the first of a series the object of which is to give information about the experiment stations and their work by collating results bearing upon special topics, and putting them into brief, clear, practical form for farmers and others

to read. A series of experiment-station bulletins, of which the first has been published, is intended to furnish accounts of current operations of the stations, and kindred information for station workers and others interested in agricultural science.

What the Stations are for.

"Farming is a perpetual trying of experiments with soils, manures, and crops; with cattle and cattle-food; with milk, butter, and cheese; with ploughs, harrows, and harvesters; with an almost endless list of things. The most successful farmers — those who get the most out of their land, their cattle, their crops, their fertilizers, their implements, and their labor — are those who experiment themselves most industriously, most skilfully, and most intelligently, and who take the fullest advantage of the experiments of others. The best agriculture is that which, in old countries, on worn and intractable soils, has learned by long-continued and varied experiment to make the gain of farming sure."

Once the farmer made the rude tools he needed for the primitive practice of his art. Now he employs implements and machinery which can be made only with large capital and the highest mechanical skill, and by men who make this manufacturing a business. So the experiments which he can make do not meet his needs to-day. Research, the finding-out of nature's secrets, the discovery of the laws which underlie the right practice of agriculture, is costly. The more useful it is to be, the greater must be the outlay of money, labor, and scientific skill. Here, if anywhere, wise economy calls for the best.

Within recent times farmers, and men of science interested in farming, have seen the advantage of using the resources of science to improve the practice of agriculture, and have established agricultural experiment stations.

The object of these stations is to experiment and to teach, "to make a regular business of discovery for the use of farming," "to promote agriculture by scientific investigation and experiment," and to diffuse as well as increase the knowledge which improves farm-practice and elevates farm-life.

Established for the benefit of agriculture, and hence of the community at large, the most of them connected with educational institutions where experience shows their work is most successfully done, these stations seek answers to the questions which agricultural practice is asking as to the tillage of the soil; the nature and action of manures; the culture of crops; the food and nutrition of domestic animals and of man; the production of milk, butter, and cheese; the diseases of plants and animals; and, in general, whatever the agriculturist needs to know and experimental science can discover.

But farmers have asked and have received from the stations more than the help to improve their crops and their cattle and to make more money. They have felt the need of something higher and better for themselves, their wives, their children, their homes, and their profession. In the isolation and the day-by-day struggle of farm-life, the opportunity for intellectual culture is all too small. Modern science reveals operations of nature in their truth and beauty, and lifts us, by their contemplation, out of ourselves to higher things. It finds as much that is wonderful in the growth of a blade of grass as in the motions of the planets, as much of inspiration in the process by which a clod of earth gives up its fertility as in the forces that keep the stars in their places in the universe. It shows us how the things we have to deal with in our homeliest toil connect us, if we but understand the linking, to what is most elevating in man's thought and hope. It helps supply that food for the mind without which we starve in drudgery, but by the strength of which we rise to a higher plane of life. It is for the acquiring and diffusing of such knowledge, which is explained in books, popularized in lectures, and disseminated in the columns of the best papers; which interests the home circle, and supplies themes for farmers' institutes and conventions; which helps farmers to improve their business and increase their incomes, while it elevates farming as a profession, and, what is by no means the least of its benefits, shows the boys that it is a profession in which brains can be used with profit, — it is for this, as well as for their help to farm practice, that experiment stations are established, and their workers are laboring with so much enthusiasm.

What the Stations do.

The stations make experiments in the laboratory, the greenhouse, the garden, the orchard, the field, the stable, and the dairy. It is doubtless safe to say that there are few subjects which the farmer has to deal with in the tillage of the soil, the saving and use of manures, the cultivation of his crops, the care of his stock, the management of his dairy, and the preservation of his crops or stock from insect pests and from diseases, that are not being studied, directly or indirectly, by one or more agricultural experiment stations.

The space here allows only a single illustration of the methods and spirit of experiment-station work. Suppose the question to be one of feeding. What are the effects of different kinds of fodder, as hay, corn-meal, or bran, fed to cows, upon the quantity or quality of the milk? Or what feed shall we use to make better pork at less cost? Or what are the most economical rations for fattening steers or working horses? To get answers to these questions, the stations make actual tests by feeding the animals and noting the results. These tests differ from ordinary farm experiments in that they are more elaborate and accurate; in other words, more scientific.

Successful feeding is not merely a matter of so much hay, or corn, or turnips, but of the nutritive ingredients which they contain, and which the animal digests, and uses to make blood, bone, muscle, fat, or milk, or uses as fuel to keep it warm and give it strength for work. The chemist of the station, with the apparatus of his laboratory, analyzes the material fed; that is to say, he separates the food into its constituent parts, and finds just how much of each nutritive substance the animal consumes. Sometimes the excrement, the undigested portion, is also weighed and analyzed; so that, by comparing this with the food, he learns how much of the whole food and of each ingredient the animal actually digests. In experiments with milch cows, the milk is likewise weighed and analyzed, and sometimes the cream is churned to see how much butter it will make. In some experiments even the air the animals inhale and exhale is measured and analyzed with the aid of very elaborate apparatus. When the feeding-trial is done, the animal is sometimes slaughtered, and the different portions likewise weighed and analyzed. By such means the effects of different kinds of fodder, and methods of feeding and treatment, are learned. A single experiment often requires the labor of several men for weeks or months. The same experiment has to be repeated again and again with different animals, under different conditions. So much does it cost to get reliable answers to the seemingly simple questions which farmers ask.

A recent editorial in one of our leading live-stock journals says that "by the feeding-trials already conducted, especially with young animals, it has been demonstrated that different feeds modify the relative proportion of the different organs of the body; that the blood can be increased or diminished, the liver made larger or smaller, the muscular system increased or decreased in proportion to the rest of the body . . . [even the bones can be made weaker or stronger]. These marked differences in results are not produced either by over or under feeding, but by the difference in the chemical constituents of the ration. Here is a side of live-stock management that is practically new to us, and its development must be of the highest importance."

It is an old saying that "the best part of the breed goes in at the mouth;" but it has been reserved for the experiment stations to show how and why this is so, to give the scientific explanation of the maxim, and to put stock-feeding upon a more rational, that is to say, a more profitable, basis. And they are studying in like manner, and with like results, the other important problems upon which the future progress of our agriculture depends.

Origin and Development of the Stations.

Nearly forty years ago a company of farmers joined themselves together in the little German village of Moeckern, near the city and under the influence of the University of Leipzig, called a chemist to their aid, and, with later help from government, organized the first agricultural experiment station. Liebig in Germany, Boussingault in France, Lawes and Gilbert in England, and other great pioneers, had been blazing the path of progress for years before.

A great deal of research bearing upon agriculture had been and is still being carried on in the schools and universities; but the action of these Saxon agriculturists in 1851 marks the beginning of the experiment station proper, — the organization of scientific research with the aid of government "as a necessary and permanent branch of agricultural business."

The seed thus sown has brought forth many fold. In 1856 there were five, in 1861 fifteen, in 1866 thirty, and to-day there are more than one hundred, experiment stations and kindred institutions in the different countries of Europe. In each of these, from one to ten or more investigators are engaged in the discovery of the laws that underlie the practice of farming, and in finding how they are best applied.

So rapid and so sure has been the progress of this enterprise in both hemispheres, that private persons, educators, societies, and governments have learned the usefulness, and indeed the necessity, of these institutions, not for the farmer alone, but for all who are dependent upon the products of the soil. The movement is extending to Asia and to South America: everywhere, indeed, its importance is coming to be felt.

The first agricultural experiment station in America was established at Middletown, Conn., in the chemical laboratory of Wesleyan University, in 1875. The example was speedily followed elsewhere. In 1880 four were in operation, and in 1887 there were some seventeen of these institutions in fourteen States. In that year Congress made the enterprise national by an appropriation of $15,000 per annum to each of the States and Territories which have established agricultural colleges or agricultural departments of colleges. This has led to the establishment of new stations, or the increased development of stations previously established under State authority; so that there are to-day forty-six, or, counting branch stations, fifty-seven, agricultural experiment stations in the United States. Every State has at least one station, several have two, and one has three. Before provision had been made by the last Congress for the admission of the new States, Dakota had established one within her boundaries, and several other Territories are preparing to do likewise.

These forty-six stations now employ over three hundred and seventy trained men in the prosecution of experimental inquiry. The appropriation by the United States Government for the fiscal year just closing, for them and for the office of experiment stations in this department, is $595,000; for the coming year it is $600,000. The several States appropriate about $125,000 in addition, making the sum total of about $720,000 given from public funds the present year for the support of agricultural experiment stations in the United States. This may seem like a large sum to expend annually for agricultural experiments, but it is less than 10 cents for each of the 7,500,000 farm-workers of the country, less than 2½ cents for each of the 30,000,000 of our population directly dependent upon agriculture for their support, and less than 1¼ cents for each of the 60,000,000 of our people who consume the products of our farms. The farming-lands, farm-implements, and live-stock of the country are estimated to be worth $12,000,000,000. The experiment stations cost us, therefore, about $6.25 a year for every million dollars invested in agriculture; or, reckoning the annual value of the products of our farms at $2,200,000,000, we are now spending about 33⅛ cents for every thousand dollars' worth of products in an attempt to increase the value of those products in future years.

The European Stations.

Of the experiment stations and other like institutions for agricultural research in Europe, sixty-two are in Germany. These latter employ two hundred and seventeen scientific specialists. According to the best accessible accounts, twenty-seven German stations exercise control of commercial fertilizers, twenty-nine of feeding-stuffs, and thirty of seeds by examination of wares in the interest of the purchaser; this, however, in most cases, being only part of the work done. Some stations follow a number of lines of inquiry, others confine themselves to one or two. In general, those have been most successful which have studied the smallest number of questions in proportion to their resources; or, to put it in another way, experience has shown the advantage of specializing. Fifteen are devoted mainly to investigations in vegetable physiology, including nutrition of plants; seven to animal physiology, including feeding-experiments; three to dairy industry; four to sugar-beet and three to fruit and vine culture. Nine have buildings for vegetation experiments, four have special structures for feeding-experiments with animals, and two have experimental gardens. While they conduct more or less field-experiments (the first station was started on a farm), few own experimental farms; and those few make but little use of them, for the simple reason that experience has shown, that, generally speaking, the things which most help farmers, outside of what they can study on their own farms, the stations can best find out in the laboratory, the greenhouse, and the experimental stable. They have learned the costly but most valuable lesson that the kind of experimenting which seems on the surface the most practical is apt to prove the least useful, and that it requires abstract and profound research to discover the things which the plain, ordinary farmer needs to know.

The European stations have become as firmly established as schools, and for the same reason; namely, that their value is demonstrated beyond question. A single illustration of their usefulness will suffice here. "The consummate product of applied farm-science is the 'Farmers' Almanac,' which tens of thousands of German farmers carry in their pockets. It contains a calendar; tables of movable feasts; blanks for daily memoranda, cash accounts, and so on, such as we have in our diaries. Then follow blanks for names of workmen, their work and wages; forms for registering cows and their daily or weekly yield of milk, and for other stock; other forms for keeping account with each field on the farm, — its size, crop, manure, seed, and produce; and so on. Then comes a series of tables and statements which compress in brief space an amount of pertinent information that is almost marvellous.

"One table gives the amount of seed by weight or measure needed per Prussian acre (morgen) or hectare, broadcast or in drills or hills, for each of ninety-five different kinds of crops. Another gives what they call in Germany fair yields (they would be large yields here), with duration of germinating power of the seed, period of growth of the plants, and what corresponds in German weights and measures to weight per bushel or bulk per 100 pounds of the different kinds of produce. Further on are tables of mixtures of grass-seeds for different soils and purposes, number of plants per acre, valuation of seeds, and so on.

"But the most remarkable tables are those of the chemical composition of plants, fertilizers, feeding-stuffs, fodder-rations, and human food, and even of the whole bodies of animals.

"If the farmer wishes to find how much plant-food he has removed from his field in a hay-crop of 5 tons, he turns to a 'Table for Calculating the Exhaustion and Enrichment of the Soil,' and finds that the 5 tons of hay would contain about 155 pounds of nitrogen, 132 pounds of potash, 8½ pounds of lime, 41 pounds of phosphoric acid, and so on. The composition of nearly two hundred kinds of grasses, grains, straws, root-crops, etc., are given in this table. If he now wishes to calculate how much plant-food he gives back to his field with a given amount of manure, he turns to another part of the table, and finds the average composition of one hundred and twenty-six kinds of manures and fertilizing materials. There are, too, clear figures and explanations to help him calculate how the analysis of a fertilizer compares with standard articles of this sort, and what it is worth. From other pages he learns how to calculate how much material ought to be produced by given kinds of animals from given food, and so on.

"Not a bit less valuable are the tables of the composition of feeding-stuffs and fodder-rations. The farmer sees at a glance how many pounds of the valuable food-ingredients — proteine, carbohydrates, and fats — there are in hay, straw, corn-stalks, bran, cotton-seed meal, and two hundred and fifty other materials which German farmers feed to their stock. Close by is a table of feeding standards, which tells how much of each of these ingredients will make a fair daily ration per 1,000 pounds, live weight, of oxen at rest in the stall, oxen at work, milch cows, young cattle, and so on. By comparing the composition of these standards with that of the feeding-stuffs in the barn or store, rations can be calculated which will bring the largest amount of work or meat or milk at the least cost. Of course, these rules are not to be followed

blindly: experience and good judgment combined with the rules make the book useful to the farmer."

The information contained in the almanac does not all come from the agricultural experiment stations; but a large amount of it, and that which is really most useful, does come from them, and would not be available without them. Nor is this all. The disposition and ability to use all this are as important as the information itself. This, too, is greatly aided by the scientific and educational work of the stations.

We want the same things in this country. Much of the fruit of foreign research and experience can be made available for our own use; but it needs working over to fit it to our needs, and we must have independent investigation of our own.

What the American Stations are doing.

Although the first of the American stations was established less than fourteen years ago (Oct. 1, 1875), and the majority of them have been in operation scarcely a year, they have already done a large amount of work scientifically creditable, and of the largest practical value. Future publications of this office will describe what the stations are doing, and explain the practical results. Only a few general statements and illustrations can be given here.

Our stations are conducting a large amount of scientific research in the laboratory and the greenhouse, and an equally large amount of practical experimenting in the field, the orchard, the stable, and the dairy. Some stations make a specialty of experiments with home-made and commercial fertilizers; others are endeavoring to show what can be done to restore the fertility to worn-out lands; others deal largely with the culture of fruit in orchards and vineyards; others are engaged on work relating to the composition of fodders and the methods of storing them; others are experimenting on the feeding of animals, and still others on diseases of animals and plants and their cure. Irrigation receives a good deal of attention in Colorado, sugar-making in Louisiana, wine-making in California. At least one station is doing something in poultry-raising, and another in the keeping of bees. Most of the stations give attention to several lines of work.

It is only the older stations from which we have a right to expect the most satisfactory results. The oldest is the Connecticut State Station. In this State the farmers are especially interested in manures and fertilizers, and in cattle feeding and dairying. This station has naturally devoted a large share of its attention to commercial fertilizers and feeding-stuffs. The result has been that inferior materials have been driven from the markets of the State; and not only that, but the farmers have been taught much concerning the relative values of the materials they buy or produce for feeding their crops and their stock, and how to utilize them most advantageously. Besides this and a great deal of other practical work, the station has done much to benefit other stations and the agriculture of the whole country by scientific researches relating to the methods of agricultural investigations.

When the station began its work in 1875, a number of brands of fertilizers then being sold in the State were analyzed, and their composition compared with the selling price. It appeared, that, at the rate farmers were paying, the nitrogen cost from 10⅛ cents to $1.67, and the soluble phosphoric acid from 10¾ to 25½ cents, per pound. The report of the station for 1888 shows the nitrogen in the fertilizers sold in the State in that year to cost from 12 cents to 18 cents, and the soluble phosphoric acid from 8 cents to 8½ cents. There were no fraudulent articles in the market. Connecticut farmers pay over $200,000 yearly for the phosphoric acid of commercial fertilizers. In this item alone the station saves more than its cost.

Before the establishment of the stations, very few farmers in New England knew how to judge of the value of a guano or phosphate from its composition. Chemical terms were Greek to them. Of the demands of plants and the deficiencies of soils, they had very little idea. Two or three years ago an advertisement of a firm of fertilizer manufacturers was circulated in Connecticut and in other States thereabouts. There was not a word in it about the remarkable increase of crops which the fertilizers would bring; there was not a single recommendation from a farmer who had put them to practical test, and learned their wonderful value; but there were statements of percentages of nitrogen, of phosphoric acid, soluble, reverted, insoluble, and of potash as sulphate and chloride, which the fertilizers had been guaranteed by the manufacturers to contain; and alongside these were given the percentages which had been found in the articles as the farmers had bought them and the stations in their behalf had analyzed them. This is a firm of shrewd business-men, who manufacture and sell fertilizers to make money. They had found that farmers had learned something of chemistry, and were buying their fertilizers on a scientific basis, and that to get the most and the best trade it would pay them to advertise and sell on that basis.

At a meeting of the Connecticut State Board of Agriculture, in December, 1888, one day was devoted to the experiment stations, of which there are now two in the State. It has been the policy of the stations to institute experiments among farmers on their own farms, both for practical and for educational purposes. Some of the experimenters were present, and gave accounts of their work regarding the use of fertilizers, and what they had learned from it. They talked of nitrogen, phosphoric acid, and potash; of agricultural and commercial values of fertilizing materials; of the feeding capacities of different plants; of the differences in soils; of the adaptation of fertilizers to soil and crop; of the relative merits of commercial fertilizers and farm manures as shown by the cost, composition, and effect upon quantity and quality of crop produced; of the different methods of applying manures; and of other kindred topics. Their statements were scientifically accurate, and the practical value was so plain as to be appreciated by every one who heard them. One of the station directors, a college professor, remarked that he sat through the whole discussion ready to rise and make explanations if they were called for, but found no occasion to do so, and felt as though his occupation was gone.

The men who thus united science with practice, who showed their fellow-farmers how much of pecuniary profit as well as mental satisfaction there was in all this work, earn their living on their own farms by the labor of their own hands. They had enjoyed no better education than their neighbors, but they had taken advantage of the help of the experiment station. Such men are lighthouses. The value of their influence cannot be estimated. Where such work is done, farming will flourish. The tendency of such things is to make agriculture a profitable, elevating, and attractive profession.

The experience in other States is the same as in Connecticut. A farmer in New Jersey, who has conducted some of these experiments under the direction of the station in that State, says that the simple fact that he has learned from them "that his soil lacks potash," which is cheaply supplied by German potash salts, has already been worth $500 to him. Another farmer in the same State told the writer that the information he had got from these experiments had been worth more than $2,000 to him in a single year. And it must be borne in mind that the subject of "fertilizers" is only one of the many which the stations are working upon.

The first decade of the life of the North Carolina Station, which was begun in 1877, has been devoted, for the most part, to problems relating to the control of the trade in commercial fertilizers, to the investigation of natural fertilizers (marls, phosphates, etc.) and the best methods for their use, and to the education of the farmers about farm manures and the best ways of saving, composting, mixing, and using them. Among the valuable results due directly or indirectly to this work are an increase of 14 per cent in the quality of the commercial fertilizers sold in the State, and a decrease in the number of acres devoted to cotton; the establishment of fertilizer factories and cotton-seed-oil mills in the State, and the making of thousands of home-made composts by farmers in every section of the State.

The New Jersey State Station was established March 18, 1880. Its work has been both scientific and practical. The analyzing of commercial fertilizers, fodders, and feeds offered in the markets of the State has been largely and regularly carried on, with important results in securing purity of product and honesty of dealing, and in teaching the farmers of the State the real commercial and agricultural value of these fertilizers. Field-experiments have been made with a large variety of barnyard and commercial fertilizers on different crops in most of the counties of the State.

The diseases of plants, vines, and trees have been studied, and remedies sought, and the station has tried to introduce new crops in sections of the State hitherto comparatively barren. The sorghum experiments for this purpose have attracted attention throughout the whole country. It is safe to say, that, in the scientific and practical value of its work, this station is equalled by extremely few of the European stations.

The station had been steadily growing in the favor of the farmers and general public of the State, and is now regarded as an educating agency of the first importance. Farmers depend upon its work, manufacturers of fertilizers are made careful, dealers in seeds and implements seek its approval. The progress of agriculture in New Jersey is marked by larger staple crops; higher enrichment of the soil; extended cultivation of market-garden products, peaches, and small-fruit; and a great increase in dairying. Even from year to year the progress is plainly marked. That the station contributes much to this progress, there is no room for doubt.

Louisiana has three stations, the first of which was established in October, 1885, by an association of sugar-planters; and the last, in April, 1888. These stations have already accomplished much useful work, including investigations of the manurial requirements of various staple crops of the State; analyses and classification of the soils of the State; analyses of all the commercial fertilizers sold in the State; experiments with forty-two varieties of cotton to determine the relative yield of lint, length of staple, and strength of fibre; and the introduction, with the aid of the United States commissioner of agriculture, of more than seventy varieties of sugar-cane, forty-eight of which are now cultivated in the State. Each station is the headquarters for a large agricultural association, which holds monthly meetings on the station grounds. At the North Louisiana Station, at Calhoun, the farmers have raised by subscription the means to build a hall for these meetings, which are frequently attended by several hundred farmers. During the season for sugar-making, the sugar experiment station, which has quite recently been moved from Kenner to Audubon Park, New Orleans, is visited by planters from all parts of the world. The average number of visitors at this station during the past season was about one hundred a day.

The influence of the Wisconsin Station within the State has been very marked. Its experiments on pig-feeding are favorably known throughout the whole country. The following extract from a letter from Director Henry indicates some of the other good things which the station has done and is doing: "Years ago the station, then called the Experimental Farm, sent out the Mansury barley, which has been worth a very considerable sum to our people. Last spring, after a year's patient work, our first assistant chemist announced the completion of a method by which an ordinary dairyman, with a reasonable amount of care, can determine the percentage of fat in milk or cream with about as much accuracy as the chemist by the gravimetric method. This method of determining fat is being brought into general use by dairymen and others. Last summer our chief chemist, Dr. Babcock, announced the discovery of fibrine in milk, and stated that this new compound played an important part in the raising of cream. Work at the station yet to be announced shows that this discovery is of considerable importance to dairymen, and in it we have an explanation of many of the phenomena of milk and cream."

Similarly favorable reports might be given from stations from Maine to California, and from Alabama to Michigan, wherever the experimenting has been carried on long enough to give a fair test of its value.

Americans have the credit of dropping enterprises which do not pay. It is a significant fact, therefore, that no State which has once established a station has ever abandoned it. On the other hand, the revenues which the stations derive from the States, apart from those which they receive from the National Government, have steadily risen from $2,800, with which the first station began, to more than $125,000 in the present year.

Even if some of the newer stations have as yet brought but little fruit and some that is not well matured, we may confidently expect before many years to have institutions in all the States which will be of the highest service to American agriculture.

One most favorable indication is the earnest desire of the managers of the stations to do the best possible work. This has been particularly manifest at the conventions of the Association of American Agricultural Colleges and Experiment Stations, in which matters of station policy have formed the principal theme of discussion. The underlying thought has uniformly been to learn to do what will best serve the interests for which the stations are established.

The experiment-station enterprise is now equipped for its great work. From its small beginning, fourteen years ago, it has grown out to the farthest limits of our land, has enlisted the best colleges and universities and the ablest investigators of the country, and secured both State and National resources for its service. It has the favor not only of leading minds in science and education, but also of a great army of practical farmers, to whom it has already brought substantial benefits. As the first secretary of agriculture has justly said, "Of all the scientific enterprises which the government has undertaken, scarcely any other has impressed its value upon the people and their representatives in the State and National legislatures so speedily and so strongly as this. The rapid growth of an enterprise for elevating agriculture by the aid of science, its espousal by the United States Government, its development to its present dimensions in so short a period, and, finally, the favor with which it is received by the public at large, are a striking illustration of the appreciation, on the part of the American people, of the wisdom and the usefulness of calling the highest science to the aid of the arts and industries of life. The present is an auspicious time for this undertaking. 'In the history of no nation before have there been such a thirst for knowledge on the part of the great masses of the people, such high and just appreciation of its value, and such wide-reaching, successful, and popular schemes for self-education; no other nation has so large a body of farmers of high intelligence; never before has the great agricultural public been so willing, and indeed so anxious, to receive with respect and use with intelligence the information which science offers; never before has science had so much to give.' The prospects, then, for this, the largest scientific enterprise in behalf of agriculture that any government has undertaken, are full of promise."

The Office of Experiment Stations of the Department of Agriculture.

The number and diversity of problems to be solved in the widely separated sections of our country, the need of linking the stations together, of helping to co-ordinate their efforts, of bringing to them the fruits of accumulated experience, of assisting them in research, and of collating their products and making them available to the public whom they serve, and the evident propriety that the Department of Agriculture should aid the enterprise in these respects, — all these considerations evince the wisdom of Congress in providing for a central office, as a branch of this department, to meet the need.

The stations themselves, through the Association of American Agricultural Colleges and Experiment Stations, were the prime movers in securing the establishment of this office, and have given to it their cordial sympathy and support.

ENEMIES OF THE PLANT-LOUSE.

THE importance of parasitic and predaceous insects in overcoming our insect pests has long been recognized by the practical entomologist. He sees the destroyers swept off as by a flood, and sees in these prolific friends the easy solution of the problem of insect years. He knows, that, were it not for these friends, the destroying hosts would make our earth a desert, and replace plenty with famine. He knows that adversity among these tiny helpers means success to the swarms of insects that devour the crops, and so is rejoiced when he sees these little helpers active and numerous.

The present season has furnished a vivid illustration of this important and interesting fact. On June 30 the heads of wheat in Michigan were crowded with hungry *Aphides*, or plant-lice. These myriad lice, often five or six around a single kernel of wheat, and two hundred on a single head, were sucking the sap and very vi-