

# The State Experimental Department for Plant Culture, its Organisation and Administration.

## An Historic Account

on the Occasion of the Twenty-fifth Anniversary of the Founding  
of the State Board of Plant Culture.

By H. C. Larsen.

The first stationary field experiments, which were carried out at the cost of the State, were located on the experiment field of the Royal Veterinary and Agricultural College in Copenhagen, a few years after the founding of the college in 1858. The experiment area comprised 11 ha,<sup>1)</sup> and the object of the work, — based on experiment plans from Rothamsted, England, — was to discover the most beneficial conditions for the development of our ordinary cultivated plants, in so far as the method of cultivation exerts any influence on these. The greatest emphasis was placed on fertilising experiments to show the effect of stable manure and various artificial fertilisers, crop-rotation to test the influence of the preceding crop, and a series of minor cultivation experiments mainly laid out with a view to teaching. The experiments were planned and led by Professor *B. S. Jørgensen*. The fertilising and crop-rotation experiments were continued without change until 1895, more than thirty years; however only the results of the first series of years were published, and they can hardly be said to have had any great influence on the further development of experiments in plant culture in Denmark. The same is true of the plan for establishing permanent, in the main small, experiment farms in various parts of the country proposed by the Agricultural College Commission of 1887, and worked out in detail by *N. J. Fjord*, lecturer at the College.

Contrary to the case with experiments in animal husbandry and dairying, (State Laboratory of Agricultural Research) the experiments in plant culture were not connected with advanced teaching, nor in any other way arranged for from without; they were a natural out-growth from within, from farming and its organisations, due to the

<sup>1)</sup> 1 ha = 2.47 acres.

initiative of a few far-sighted, understanding practical men among whom *P. Nielsen*, *E. Tesdorpf*, *J. C. la Cour*, *T. Westermann*, *Chr. Sonne*, *L. Helweg*, *Fr. Hansen*, and *K. Hansen* deserve first mention. These men were associated with agricultural organisations in various ways, at that time in particular with the »Society for the Improvement of Cultivated Plants« which was founded in 1876, and the Royal Danish Agricultural Society, which in 1882–83 appointed its Wheat and Malt-barley Commission, and which had already for several years supported *P. Nielsen's* work in plant culture.

*P. Nielsen* (see p. 2), the son of a small-holder from Southern Jutland, was born July 28, 1829. Until twenty-seven years of age he worked on a farm, he then passed his normal school examination, and in 1859 was appointed village-school master in Ørslev by Skelskør, where he taught for twenty-seven years. Together with his teaching, *P. Nielsen* devoted much time to botanical studies and accomplished not alone a pure scientific work in this field, but was led in the course of years to take up practical experiments and investigations with cultivated agricultural plants, as well as with weeds, plant diseases and the methods to be used in combatting them.

At the opening of the 70's — exactly 50 years ago — *P. Nielsen* began a series of comprehensive and very thorough investigations of the plants on grass fields to show the value of various forms and varieties under different conditions of cultivation. These investigations were made on his small-holding belonging to the Ørslev village-school which comprised 3.5 ha land and on many different farms all over the country, but especially on Etatsraad *E. Tesdorpf's* large farms on the Islands of Lolland-Falster. Little by little *P. Nielsen* was able to recommend suitable seed mixture for grass fields and to establish important rules for fertilising and sowing, for resowing and treatment under various conditions. The farmers had confidence in his work and followed his advice and suggestions in this as well as in the other departments of plant culture, cereal-growing, forage crop and weed investigations, in which he was interested. By degrees his entire small-holding was given over to experiments in cultivated plants, and all his time and strength devoted to a very large private correspondence and a very comprehensive work as advising specialist.

The President of the Royal Agricultural Society, *E. Tesdorpf*, had early called the attention of the Society to *P. Nielsen's* work, and in 1877 the Society voted an annual sum of 600 Danish crowns so that he might pay an assistant at the school and »continue his investigations on grass-fields, the cultivation of forage crops, and the destruction of weeds and parasitic fungi«. In 1882, with the consent of the Ministry of the Interior, he was appointed Agricultural Adviser to the Royal Agricultural Society and Experiment Leader in Plant Culture with a salary of 2000 crowns annually and a grant of 1000 crowns annually for an assistant in plant culture. The Ministry refunded the

sums to the Society and these 3000 crowns thus became the first State subsidy granted to experimental and advisory work in plant culture.

The work, however, continued to grow and after a few years it was apparent that the small-holding farm of the Ørslev school was too small to contain all the experiments which were to be made, and that in order to retain *P. Nielsen* for experimental and advisory work he must be released from his school duties, and an arrangement made whereby he could devote all his time and energy to the service of agriculture. This was brought about in 1885 on the initiative of the Royal Agricultural Society, and the Budget of the fiscal year 1885—86 contained a grant of 10,000 crowns to be paid annually, 3,000 crowns of which were to be used as a salary for *P. Nielsen* and 7000 for experiments. The first year the latter sum was to be used partly for the running expenses and enlargement of the experiment field and experiment work at Ørslev, the acquisition of a suitable dwelling there, and partly for the establishment of sub-stations in other parts of the country, by which greater security for the results already won could be attained, as well as a better opportunity for these to find their way from the scattered stations out among the population, there to be of assistance.

Already in the spring of 1885 the first sub-station was established near Askov in southern Jutland. Here experiments of limited extent were laid out on a suitable area of 1.6 ha loamy soil of Øster-Havgaard Farm belonging to *Fr. Hansen* (see p. 3), an agricultural graduate, then teacher at the Askov Peoples High School, as well as on 0.3 ha very light sandy soil, typical of large stretches in southern and central Jutland. The local leadership was given to *Fr. Hansen*, who, according to a report from *P. Nielsen* to the Agricultural Society »was, on every side, described to me as a gifted, clever, conscientious man, who may be assumed to possess the required energy, perseverance, accuracy and sense of order, — all traits quite indispensable for an experiment leader«.

The plan of enlarging the experiment field in Ørslev had, on the other hand, to be abandoned, as it proved impossible to secure the title to sufficient ground there. However Kammerherre<sup>1)</sup> *C. Castenschild* to Borreby, offered *P. Nielsen* the choice of 11 ha from his estate to be used for experimental purposes and promised to construct the necessary buildings on the ground. After looking over the available land on the adjacent estate, *P. Nielsen* found, in the summer of 1885, what seemed suitable in a leasehold farm in Tystofte, near Skelskør, of 30 ha — »of which, the necessary examination of the soil having been made, a large part seemed admirably adapted to experiment fields. The mould may be designated as easily crumbling, loamy, soil, readily managed, and, with but a slight exception, a perfectly even surface. The subsoil consists of clay mixed with sand«. The

<sup>1)</sup> chamberlain.

experiment field, 11 ha, was surveyed, divided off and enclosed, and the necessary buildings constructed during the autumn and winter, and, according to *P. Nielsen's* plan, equipped for experiments. The State granted the owner 5000 crowns for building. *P. Nielsen* was given a lease for life of the property while the State reserved the right of pre-emption.

In the spring of 1886, then, the Experiment Station at Tystofte was established. *P. Nielsen* now resigned his position as school-master in Ørslev, was appointed State Adviser and Director of the Experiments in Plant Culture, and moved to Tystofte in the summer of 1886. The new experiment field came at once into use and by degrees, in 1886 and the years immediately following, as the soil was prepared, the experiments were transferred from the old experiment field at Ørslev to the new Tystofte Experiment Station.

In this way *P. Nielsen* founded the State Experimental Department for Plant Culture.

Until this time the Royal Agricultural Society had led and promoted both experimental and advisory work, and had had control of the funds granted by the State. According to a decision of the Parliament and the Ministry this condition was to remain unchanged and *P. Nielsen*, by his own wish, was to continue in the same relation to the Society so that the money, granted annually for expenses connected with the experiments, should be used according to agreement with the Society and under its supervision. *P. Nielsen* brought before the Society his plans and suggestions in regard to the budget, and the changes and extensions necessary; and on this as a basis the society presented to the Ministry its claims for the experiments, for the organisation and leadership. Thus to the authorities granting funds, the Society stood as a guarantee for *P. Nielsen* and his work, and for the way the funds were used. The experiment plans were laid before the Society and the annual report of the work done published in its official journal, and thus made known in wide circles.

At that time *N. J. Fjord*, the teacher, was the acting President, and Captain *J. C. la Cour* (see p. 17), the Secretary of the Royal Agricultural Society; both enjoyed productive co-operation with *P. Nielsen* and took part in the administration of the work with great energy and enthusiasm. The technical leadership, however, was entirely left in *P. Nielsen's* hands. In the years which followed, this developed considerably; at Tystofte experiments with root crops and potatoes were added, later, experiments with stable manure and artificial fertilisers, these last necessitated including several of the adjacent fields; at Askov experiments were made with rotation of crops and with fertilizers, especially with regard to the light soils of Jutland. Already in 1887 and 1888 the experiment area of sandy soil at Askov was increased to 1.7 ha and the annual grant to that station, beginning with the fiscal year 1889—90, increased with 2000 crowns, of which 1200 comprised *Fr. Hansen's* salary, and 500 help in compiling the experi-

ment material, while extra 1500 crowns were conceded that one year for building a barn etc., 500 crowns were granted for chemical investigations of the content of nutritive substances in various root crops; at the same time *P. Nielsen's* salary as State Adviser and Director of the Experiments was increased from 3000 to 4000 crowns annually. The reasons given by the Society for this step were not only his great services, but also the fact that every year a considerable sum was required for representation. He receives many visitors, individuals as well as associations of farmers, both from neighboring communities as well as from more distant parts of the country, also farmers and scientists from other countries (Sweden, Norway, Germany and France); the majority of these only remain a day, but some remain several days to thoroughly study his many and interesting experiments.

From 1889 to 1893 the annual grant to the experimental work was 13,500 crowns.

#### The State Experiments Reorganised and Enlarged.

In the course of years and parallel with the State Experiments in Plant Culture and in part in co-operation with them, two other co-ordinate institutions, also dealing with experiments in plant culture and receiving State support, had developed, »The Society for the Improvement of Cultivated Plants (Society for Domestic Seed Cultivation)« and the Malt-Barley and Wheat Commission of the Royal Agricultural Society, formed in 1888 by the union of the Malt-Barley and Wheat Commissions of 1881—82. The first of these societies, whose aim was »to gain and spread knowledge of the cultivation of the best varieties of cultivated plants, especially agricultural plants« began as early as 1880 to make cultivation experiments, first with foreign potato-varieties, later with leguminous plants and grasses, and finally, from 1886, after several years preparation, cultivation experiments with root crops, with the emphasis on the strain. To lead these investigations, which were carried out on several farms in different parts of the country as »ambulatory« or »movable« experiments, the society appointed a horticultural graduate, *L. Helweg*, (see p. 9) who, during the seven succeeding years, until the discontinuance of the Society, served with the greatest zeal, enthusiasm and interest. The results were published in the organ of the Society, »Om Landbrugets Kulturplanter og dertil hørende Frøavl«, founded in 1879 and edited by the Secretary, *E. Rostrup*, (see p. 67), Lecturer at the Royal Agricultural College.

In order to make experiments with cereals and leguminous plants, in 1890 the Society rented 2½ ha loamy soil near Lyngby, and appointed *K. Hansen* (see p. 9), an agricultural graduate, with special training, as Director of Experiments. In the years which followed, a series of cultivation experiments, particularly with varieties of cereals

and seeds of leguminous plants, breeding experiments with the same, and other similar experiments were made on this experiment field.

Many institutions made annual contributions to the Society, the Royal Agricultural Society, which was closely connected with it, paid 500 crowns a year for several years, until the State, in 1887, assumed the responsibility and granted 3,000 crowns annually, and from 1888, 5,000 crowns. In the meantime the Experiments in Plant Culture and too, the Experiment Station at Lyngby made such inroads on the funds of the Society that it became impossible to take up the various problems waiting for solution without an increased State grant or co-operation between the various organisations which were working side by side to further plant culture. If the necessary State funds could be secured for a common leadership, the Society was willing, if required, to resign in its favor. Referring to this matter the Society in 1890 petitioned the Ministry for an annual grant of 15,000 crowns and at the same time wrote to the Royal Agricultural Society suggesting co-operation or consolidation between the various institutions under the Society and under the Royal Agricultural Society. Among other matters it suggested that the experiments with wheat and barley varieties which, under the Malt-Barley and Wheat Commission, with *Chr. Sonne* as experiment leader, and with an annual State grant of 8,000 crowns, were carried out in large numbers in the wheat and malt-barley districts, should be grouped under the other experiments which were paid for by the State, a plan which had already been suggested by the Wheat Commission in 1888.

The Ministry of the Interior considered the whole matter carefully and discussed it with the interested parties during the next two years. Under these discussions, although the Royal Agricultural Society admitted the advantages in a consolidation of the various institutions under the Society and the State, it wished, in view of the fact that its experiments with the cultivation of wheat and barley vary not a little in their plan and laying out from the other experiments, that in the future its experiments might continue to be led by the Malt-Barley and Wheat Commission alone, with the usual State grant. The result of the discussion was the following »Bill of 1892 on the Enlargement and Re-organisation of the State Experiment and Advisory Work in Plant Industry to go into Effect in the Spring of 1893«, a bill based on the plan of State Adviser, P. Nielsen.

As regards the remainder of the experiment work, the intention is to give the general-managership to the present Director General of Experiments and Adviser in Plant Culture *P. Nielsen* of Tystofte, to retain the main station at Tystofte and the sub-station at Askov as at present, to enlarge by locating a smaller test-station in northern Jutland (Vendsyssel) and to place the experiment station for the improvement of Cultivated Plants, under the general managership. With the help of these four stations located in various parts of the country, it is presumed that the most important problems which deal

with conditions of growth and development, yield and hardiness of agricultural plants can be solved in a sufficiently complete and satisfactory way. On account of the now increased duties of the Director General of Experiments, and for the sake of the supervision of the stations, it becomes necessary to appoint a chief assistant at the Tystofte Station and two directors at Askov and Lyngby; the chief assistant is to assist the Director General of Experiments, partly with the experimental work at Tystofte, partly with writing up the experiment material turned in from all the experiment stations, the two directors, with relative independence, are to make experiments at the stations under them, and as local advisers for Jutland and the Islands, respectively, assist the Director of Experiments in his work as adviser, by answering questions, holding lectures, etc., under the further direction of the Director General of Experiments and with his supervision. As mentioned above, the management of the Society for the Improvement of Cultivated Plants has expressed its willingness to take steps necessary for dissolving the Society: in the event of its dissolution its possessions, such as cupboards containing collections of preparations, colored drawings, various tools, the issues of the periodical of the Society »Om Landbrugets Kulturplanter«, etc. in accordance with the laws of the Society, are to go to the Royal Agricultural Society which may again place them at the disposal of the Director of Experiments.

To cover the expenses connected with the proposed arrangement a sum of 27,000 crowns is listed on the present account, to be divided as follows:

1. Experiment Station at Tystofte (18 ha.)	10200	crowns
2. » » » Askov (6 ha.)	5500	»
3. » » » Lyngby (3 ha.)	4700	»
4. Preparatory experiments in northern Jutland	500	»
5. Travelling expenses for experiment leaders and managers	1700	»
6. Analyses of cereal varieties, root crops, etc.	1500	»
7. Continuation of the experiments with cultivation of root crops and control with root seed begun by the Society for the Improvement of Cultivated Plants	1500	»
8. Publication of experiment reports	1500	»

Total... 27100 crowns

The bill was passed and the grant placed at the disposal of the experimental work through the Agricultural Society. On a proposal from this Society the Ministry passed the following Bill June 26, 1893:

#### Organisation

of the State Experimental and Advisory Work in Plant Culture under the Ministry of the Interior, to go into effect April 1, 1893:

1. The Royal Danish Agricultural Society, acting in behalf of the Ministry of the Interior exercises control with the experiments and submits to the approval of the Ministry the procurement of real assets for carrying out the experiments, such as suitable ground, buildings etc.

2. The Agricultural Society has the right of calling a meeting of those employed in the Experiment Work, for discussion and report whenever it

seems expedient. At these meetings the plan for the annual experiments and the annual budget are discussed before they are submitted to the Ministry. The local advisers take part in the meetings of the State Advisers and through the Royal Agricultural Society give an annual report of their work as Advisers to the Ministry.

3. The Director General of Experiments is appointed by the Ministry of the Interior on the proposal of the Royal Agricultural Society.

The managers of the sub-stations and the chief assistant are proposed by the Director General of Experiments, nominated by the Royal Agricultural Society and appointed by the Ministry.

The Director of the Root Cultivation- and Root Seed Control Experiments as well as the Editor of the periodical is appointed by the Royal Agricultural Society.

If one of the employees wishes to resign he must give six months notice; the method of procedure is the same as with appointment.

Dismissal can, under ordinary conditions, only occur with six months notice.

4. (Regulations in regard to the distribution and use of the funds).

5. Expenses of the employees travelling in the service of the Experiment Work are computed according to the cost of transportation plus 8 crowns per day compensation for other expenses in accordance with the general rules for State Agricultural Advisers.

6. The work of the local advisers is described in instructions drawn up by the Royal Agricultural Society and submitted to the Ministry for approval.

At the same time as the regulations went into force, *Fr. Hansen* received the appointment as State Adviser in Plant Culture for Jutland and Director of the Station at Askov, and *K. Hansen* the appointment as State Adviser in Plant Culture for the Islands and Director of the Station at Lyngby, which was now taken over by the State, both with an annual salary of 2,400 crowns, in toto, for the double position as adviser and director of the experiments. *L. Helweg* was appointed Director of the Ambulatory Experiments with Roots which were likewise under State control and given a salary of 1000 crowns annually. The position of Director General with control of the entire Experiment Department, remained as hitherto in *P. Nielsen's* hands, and the position of Editor of the periodical of the experiment work, *Tidsskrift for Landbrugets Planteavl*, with *E. Rostrup*, who had edited the older paper — all from April 1, 1893, — the position of chief assistant to the Director General in compiling the experimental results was not filled, as no one suitable could be found.

The prescribed annual plan for the experiments was drawn up for the first time for the fiscal year, 1893—94, by the Director General and the directors. After being submitted to a thorough discussion by the Three-Man Chairmanship<sup>1)</sup> of the Royal Agricultural

<sup>1)</sup> The Royal Agricultural Society is governed by a committee of the three presidents, known as the Three Man Chairmanship. For the sake of conciseness in the future this will be referred to as chairmanship.

Society and men with practical and theoretical experience, the plan was each year approved by the Society and published in the annual report, while reprints were sent to the experiment stations for distribution to visitors, etc. The first years merely a brief summary of the objects of the experiments, their scope and location was included—the plans of each station separately—, but no indication of the size or number of the replicate plots or rules for the way in which the experiments were laid or carried out; such rules were first included in the plans from 1900 and at the same time published in the *Tidsskrift for Planteavl*, later, from 1906, they were given in even greater detail in a specially edited »working plan for the experiments« of which only a brief summary is published in the periodical.

The first experiment plan for 1893—94 included, in addition to the stationary experiments and the ambulatory root crop experiments, test cultivations of soil preparatory to laying out a new experiment station in Vendsyssel. On *P. Nielsen's* decision, the experiments were located on a peasant farm, Knoldgaard, near Vester Hassing, belonging to the estate of *M. Ahlmann*, Langholt, and containing areas of both sandy, loamy and low bog soil; in the fall of 1893 the four local agricultural societies in Vendsyssel sent in a petition to the Ministry of the Interior »that a station might be located there similar to the experiment stations which are already located at Tystofte, Askov and Lyngby«. The Royal Agricultural Society recommended the petition, and in reference to this subject on December 5, 1893, the Ministry presented a bill before Parliament to the effect that from April 1, 1894, a station be established at Vester Hassing. In the communication from the Ministry we read:

»On account of the knowledge gained from the experiments already made, it must be admitted that the establishment of a branch experiment station for plant culture in Vendsyssel, if the experiments are carried out on the same scale as at Lyngby and Askov, would benefit not only that section of the country, but also agriculture as a whole. Because of varying conditions, it cannot always be presupposed that results gained from the most southern part of Jutland and from the Islands, are also applicable in the northern part of Jutland. The establishment of the station already referred to will likewise contribute to far greater certainty and speed in that branch of experiment work, a larger material will be collected for comparison, and results which have general application will be the sooner obtained.

The management of an experiment station with an area big enough to permit of experiments on sandy, loamy and peaty soils, will entail the following annual expenses:

Salary of the experiment leader .....	2,000	crowns
Assistance. ....	1,200	»
House-rent and field-rent .....	500	»
Running expenses of the station .....	1,400	»
Total...	5,100	crowns«

The bill was passed and in the two years which followed, the total annual grant to the experiment work was 32,200 crowns. *A. J. Hansen* (see p. 13), an agricultural graduate, who had been assistant at the Station at Askov, was appointed Director of the Station from April 1, 1894, and his position made co-ordinate with the Directors of the Stations at Askov and Lyngby, without, however, his having any advisory duties.

The lines for the experiment work, which now included four permanent stations as well as ambulatory root crop experiments, were thus defined for a considerable period, until 1905. Yet already in 1896 small areas were laid out for experiments on high bog land. Interest in reclaiming and cultivating the moors had been keen for many years. The Danish Heath Society (*Det danske Hedeselskab*) had, as early as 1887, under the initiative of Major *E. Dalgas*, with the assistance of *T. Westermann* (see p. 25), turned its attention to the matter and established small ›test-stations‹ on bog land in the heath districts. As early as 1889 such a station was established on 2.8 ha of Vejen Moor, under the direction of the experiment station at Askov. In 1895 the Royal Agricultural Society took up the question, appointed a committee, including Captain *J. C. la Cour*, then President of the Society, Inspector *P. Feilberg*, and Professor *T. Westermann*. The latter, on the basis of a plan of *P. Feilberg*, proposed that the State make systematic investigations of the draining and cultivation of Danish moors and establish more comprehensive cultivation experiments both on high bogs and low bogs. The proposal met the approval of the Society and the Ministry, and on the Budget for 1896–97 was a special grant of 12,000 ›for furthering the moor question‹. This sum was largely placed at the disposal of the Danish Heath Society, which later co-operated with the State Experimental Department for Plant Culture in making the necessary investigations. The question of extending cultivation experiments on bog-lands was left to *P. Nielsen*, who decided to begin on a small scale, partly to gain experience in this new field of work, partly because men with the required training to lead moor experiments were lacking. Moreover it was ›highly urgent in this connection to enlarge the scope of the cultivation experiments on sandy soil‹ at Askov and V. Hassing as well as at the Lyngby Station ›in order to derive full benefit from the forces connected with that station‹ and from the ambulatory root crop experiments in western Jutland.

In accordance with these aims, in the spring of 1896, the Station at Askov took over an area of about 5.5 ha raw, high-peat bog soil of Vejen Moor for cultivation and experiments and at the same time enlarged the experiment area on sandy soil to about 5 ha. The experiments on low peat bog and sandy soil at Vester Hassing were enlarged correspondingly and the experiment area at Lyngby increased from 4 to 7 ha while the station was given a small sum for pot-ex-

periments, analyses and experiments on low peat bog. On the budget for 1896—97 there was an increase in the grant to experimental work of 10,800 crowns, of which 4,700 was intended for moor experiments. The total annual grant to the State Experimental Department for Plant Culture and the advisory work connected with this, was now 43,000 crowns.

**The State Board of Plant Culture Appointed,  
The State Experimental Department for Plant Culture Organised.**

On September 30, 1897, *P. Nielsen* passed away, sixty-eight years old. With his death the State Experimental Department missed its founder, leader, and administrator. The question of future management and administration, which had not been discussed while *P. Nielsen* lived, now became pressing. The Ministry of Agriculture requested the Royal Agricultural Society to consider the question and present a plan to the Ministry for this, as well as for the management of the Station at Tystofte. The three-man chairmanship of the Society called a general meeting to discuss these important but difficult questions with the chairmen of the various co-operative societies of the provinces, the Danish Heath Society, the Malt-Barley and Wheat Commission, as well as with many other competent men associated with plant culture, including the State Advisers and Directors of the Experiment Stations. All were agreed that at present no single man possessed the necessary ability and energy to take up *P. Nielsen's* important and comprehensive duties and continue along the lines followed hitherto, in other words assume the general managership and administration of the Experiments in Plant Culture, the Advisory Department and the leadership and administration of the Experiment Station at Tystofte. The work had become too comprehensive and heterogeneous,—a vast experiment material was waiting to be compiled and published and the results brought to the knowledge of the farmers. The men of ability already in the service, who were trained and practised in the work must be kept, but a division of labor must be made,—not according to districts, for unity and entirety were necessary,—but according to the nature of the problems and the natural scope and trend of the persons employed; for instance, in uniformity with the Committee on Management of the Swedish Agricultural Academy, »speakers« should be appointed to represent the various groups of experiments, to work out plans and to lead the discussion at meetings with practical and scientifically trained plant culture men, conduct the actual experiments, write up the experiment reports, etc. A unifying element, however, was lacking. Voices were raised to limit the work done at the Tystofte Experiment Station, partly because the soil outside the original experiment area, (11 ha), was less well adapted to experiments, but particularly because the experiments with artificial fertilizers which required so much room seemed better

adapted to local experiments, a method of procedure which was beginning to win favor in the agricultural societies. No definite plan was proposed, however, either for the experiment work in general, or for Tystofte in particular.

The Chairmanship allowed the subject to rest for a little and Captain *J. C. la Cour* who had plant culture work under his department, discussed the matter with the directors of the experiment stations and got them to agree in the main to the plan as it had been presented so that »co-operation could be established and assured through an administrating leader«, (presumably the Captain himself), and »control with the work as a whole left, as hitherto, with the Royal Agricultural Society«. In the meantime the second of the Society's three presidents *C. Castenschiold* to *Borreby*, presented the following proposal on October 31, 1897:

» . . . . . opinion seems to be unanimous that there should be a general directorate. However as it seems impossible to point out a single man able or willing to assume the leadership of the State Experiment Work in Plant Culture, I propose that for the present, at least, a committee be appointed composed of 3 to 5 well-informed men, that the chairman be the President of the Royal Agricultural Society, that the committee have a secretary, who shall be paid a salary, to attend to current business and other secretarial duties. This secretary should be sought among men with such qualities that with the opportunities which the position offers, he can develop and become able to fill a more responsible post in the Department of Plant Culture. In other words, the time is ripe for centralising the work in plant culture in one institution. P. Nielsen's disinclination to embrace the experiments of the Wheat and Malt-Barley Committee in his work is the only reason why they are not included in it. I think, moreover, it would be fortunate if the experiments in cultivating the moors, which are made at the Experiment Stations for Plant Culture, co-operated more closely with other institutions making similar experiments and applying them in practice, and of these the Danish Heath Society is the nearest. A co-operation with this society, so that cultivation also be tried out on the Islands on a far larger scale than the case is now, or will be, so long as the matter rests with the Society for Cultivating the Heaths, whose main interest and field of activity is Jutland, is extremely desirable. On the Islands there are such large stretches of moor-land that we can no longer be indifferent to their non-cultivation. Great energy must be used to arouse interest in the moor question on the Islands too. Our neighbors to the East and South have shown how much can be done in this regard.«

The chairmanship considered the matter, called a new meeting to discuss the question with the same men who were present the first time. Prior to the meeting, which was held December 6, 1897, the Chairmanship distributed a pamphlet containing a syllabus of the subject to be discussed, wherein we read:

The experiments in plant culture made at the expense of the State, or with State grant, should be carried out by the leaders of the experiment

stations, distributed as indicated below and under the administration of an Administrating Committee which decides:

1) The plan of the experiments, 2) The way in which they are carried out, 3) The publication of experiment results in pursuance of the proposal of the Royal Agricultural Society of June 14, 1893, approved by the Ministry June 26, 1893, by which it was determined that the Royal Agricultural Society, in behalf of the Ministry, should oversee the work, and draw up for approval by the Ministry plans for acquiring permanent property on which to carry out the experiments, such as suitable tracts of land, barns, etc.

There is no reasons for changing this regulation; however on account of the death of *P. Nielsen*, State Adviser and Director General, and as the chairmanship believes that there is no one fitted to fill his place as Director General, it is suggested that his duties be, for the present at least, placed in the hands of a committee with one of the presidents of the Royal Agricultural Society or someone appointed by that Society as chairman and comprising 3 to 5 members, men capable of bringing to the task the best possible experience in experimental work, both at home and abroad, and in the requirements which agriculture has the right to demand of experimental work in plant culture and in distributing the results. This committee bears the same relation to the chairmanship as did the Director General of Experiments, and the intention now, as heretofore, is to call an annual meeting to which representatives for those institutions which maintain some connection with the plant culture experiments of the country, are invited and submit to them the report of the year that has passed and the plan for the year to come. As it is desirable to facilitate the work of the committee as much as possible, and in order that actual results may devolve from the meetings, which will presumably be limited to three or four annually, and as by the very nature of the matter, the chairman of the committee is unable to attend to all current business between the meetings, it seems advisable to appoint to the committee as secretary, a young man, well-adapted to the position, who can both lighten and support the work and be of assistance to the chairman in arranging, preparing and putting into circulation the various matters of business.

The further membership on the committee as well as the requirements of the secretary will be discussed at the coming meeting.

Plans of the experiments should presumably be drawn up at a meeting in which the directors of the experiment stations take part, the actual way in which the work is carried out and the compilation of the results should be discussed at the same meeting; however the committee has free hands to invite directors of the experiments or any one else whose opinion they may wish to hear. A report will be kept of the meetings held.

While it is desirable to divide the work between the Directors of the experiment stations in such a way that each of these, besides leading the actual experiment work at his experiment station, is given a special experiment problem for which he is responsible, and of which he makes an independent report, the committee will publish and be responsible for the annual report of the work done by the committee and the stations; this, as well as the special reports, will be published in the official journal,

»Tidsskrift for Landbrugets Planteavl« and distributed as reprints in as many copies as the committee thinks best. The official journal shall, moreover, in addition to the joint report of all the work done, contain a brief easily-read summary of the results which have appeared during the year for the benefit of a large circle of readers who have no interest in becoming acquainted with the more detailed special reports.

As a basis for further discussion, and in reference to the enclosed report from the directors of the experiment stations, it must be said at once, that in so far as the division of special problems among the directors of the stations is concerned, it seems advisable to make the division now and permanently, so that *K. Hansen*, who at present is the Director of the Experiment Station at Lyngby, be given that group of problems dealing with comparisons of different species and varieties and improvement of strains, — in other words, experiments with the plants themselves, — and State Adviser *Fr. Hansen* in Askov, and *A. J. Hansen*, Director of the Experiment Station in Vester Hassing, be given the problems dealing with the external conditions of the life of the plants, the fertilization problem in particular, and the special sand and moor cultivation experiments in Jutland; while the work connected with local field experiments, for the present at least, is exclusive of the problems already given to each director, that is to say, now, as hitherto, each director of an experiment station is to make those local field experiments which lie within his special domain. Ambulatory root crop experiments are, for the present at least, under the supervision of *L. Helweg*.

The director of each experiment station is responsible for the supervision and all detail work connected with his station, as well as for not exceeding the sum of money granted to the station in question.

This plan was discussed in detail at the meeting, and, on the whole met with approbation. However the relations between the proposed committee and the directors of the experiment stations and the influence of the latter in planning and leading the experiments were modified to the advantage of the directors. According to the plan, the committee was to replace the Director General, both in his relation to the Royal Agricultural Society and to the directors, in other words to act as Director General. To be sure the chairmanship modified this view somewhat on presenting it before the meeting, but State Adviser *Fr. Hansen* opposed it directly on behalf of the directors and claimed that the committee should not take *P. Nielsen's* place as Director General but rather the place of the Royal Agricultural Society, »and only act with the authority hitherto given to the chairmanship, — for it must be assumed to be of the greatest advantage for stability in experiment work, that the directors be allowed to have direct part in planning, carrying out the experiments and in publishing the results. Only under such conditions is there a guarantee for steadfast work. *P. Nielsen* never drew up or proposed a plan without having discussed it in detail with all the directors.« — Of the secretary he expressed doubt as to whether, in view of the expectations aroused in regard

to his position as future leader, he would be a valuable link between the committee and the directors of the experiment stations.

This point of view was accepted by the meeting and Captain *la Cour* summarized by saying, » . . . while formerly it was *P. Nielsen* who drew up the plans and presented them to the Royal Agricultural Society, they will now be drawn up by the directors of the experiment stations and presented to a committee of three members representing the Royal Agricultural College, the Associated Danish Agricultural Societies, and the chairmanship of the Royal Agricultural Society. This committee at once assumes the position held by the Royal Agricultural Society in planning the experiments. I agree with State Adviser *Hansen* in regard to the secretary. We are seeking an intelligent, far-sighted, interested secretary, with grasp of the subject, but at the same time we place more emphasis on whether he is interested in good Danish experiment form than in high scientific motives. The influence which the secretary, the directors, or others, may gain in the development of the work will depend on ability. If a man is found, who, without neglecting the fundamentals, stands pre-eminent to all others employed in experiment work, he should be made Director General, and the present provisional arrangement set aside; his abilities demand this as a right. But it is absolutely wrong to decide in advance that this is expected of such and such a man. This should never and shall never happen.«

The question of consolidating all the experiments in plant culture, which partially or wholly depended on State support, under the State Experimental Department for Plant Culture in its reorganised form was also discussed in great detail, but no result reached other than a wish that the Malt-Barley and Wheat Commission of the Royal Agricultural Society and the Moor Commission of the Danish Heath Society would co-operate with the Board of Plant Culture (eventually supplementing it with 1—2 members) in discussing the plans and leadership of the wheat, malt-barley and moor experiments. This came to pass as far as the moor experiments were concerned, (see p. 148), but the experiments of the Malt-Barley and Wheat Commission were continued independently until 1903.

With these discussions as a basis, on December 10, 1897, the Royal Agricultural Society proposed to the Ministry of Agriculture that for the present at least, the leadership and administration of the Experiment Work be organised thus:

a. That the Ministry of Agriculture authorize the Royal Agricultural Society, which in the future, as hitherto, should be the seat of management and the keeper of the records, and too, responsible for the annual report of finances, to transfer, for the present at least, the actual administration of the Experiment Work to an acting committee, known as the *Board of Plant Culture*, and comprising three members as follows:

1. One of the Presidents of the Royal Agricultural Society, or a man chosen by them, who acts as Chairman of the Board, and who is responsible for carrying out the resolutions passed by the Board.
2. A representative from the Associated Danish Agricultural Societies.
3. A representative from the Royal Agricultural College.

It is the duty of the Royal Agricultural Society to see that one member is elected each January 1; the order of appointment is decided the first time by drawing lots. Membership on the Board is for a three year period. Members are eligible for re-election. Members give their services gratis, but the Board may seek paid assistance if necessary.

The chairmanship of the Royal Agricultural Society authorizes its representative on the Board to resolve and act on behalf of the Society, and places in his hands the supervision of the work of the advisers in plant culture hitherto under the control of the chairmanship of the Royal Agricultural Society. The Board of Plant Culture, with the help of the chairmanship of the Royal Agricultural Society, prepares the working program for the Board of Plant Culture and submits it to the Ministry for approval.

b. That a tentative working plan for the experiments be annually drawn up by the directors of the experiment stations and submitted to the Board of Plant Culture, which, after discussion with the directors and eventual modification, approves the plan.

c. That the actual experiment work, as well as management of the experiment stations and keeping within the sum granted each station for running expenses, form the duties and responsibilities of the respective directors, under the supervision of the Board of Plant Culture.

d. That the work of compiling the experiment results and writing up the technical report be divided by the Board of Plant Culture between the directors of the experiment stations after discussing the matter with them. Each director then bears full official responsibility for the report signed by him.

e. That on the suggestion of the Board of Plant Culture the Royal Agricultural Society invite, as hitherto, those institutions and men particularly interested in plant culture to discuss ways and means for its advancement.

f. That the Board of Plant Culture prepare an annual report of the work done in plant culture during the past year, and in every effective way make the final results known.

Except at the Tystofte Experiment Station, where, on account of change in the staff the ordinary budget was reduced, while an extra sum of 6500 crowns was granted for paying off the mortgage, the budgets of the single stations were unchanged. However from April 1, 1898, it was proposed to raise the total annual grant from 43,000 crowns to 46,000 crowns; of this 6,500 crowns were intended to be used by the Board of Plant Culture as follows:

Office rent, service fee and cleaning .....	500	crowns
Stationery, postage .....	300	»
Printing and distribution .....	2500	»
Salary to the secretary .....	1800	»
Travelling expenses of the secretary and members of the Board	500	»
Cost of meetings .....	500	»
Books, pamphlets, magazines, etc. ....	400	»

Total... 6500 crowns

After the Budget was passed, the Royal Agricultural Society received on April 13, 1898, a communication from the Ministry to the effect that it agreed in the main with the proposed ordering, and authorised the Society to see that the Board of Plant Culture was elected and to take other necessary steps for putting the new measures into effect, — the continuation of the work at Tystofte Experiment Station included. Opinion was unanimous that this station should be maintained in its full extent, but so modified that the Director no longer, as heretofore, have any economic interest in any of the grounds belonging to the station, now including the entire original domain, — 30 ha. From April 1, 1898, the State became leasee of the property, and the following year bought it outright for 50,000 crowns. State Adviser *K. Hansen*, Lyngby, was offered the directorship of the station, and on his refusal, *N. P. Nielsen*, an agricultural graduate, who had been assistant at the station, was made acting director and later, from April 1, 1898, Director with an annual salary of 2,000 crowns.

On the initiative of the Royal Agricultural Society, the State Board of Plant Culture was constituted in the spring of 1898. On June 14, the Society sent the Board a communication to that effect in which we read:

«Now that, with the approval of the Ministry of Agriculture, a Board of Plant Culture<sup>1)</sup> has been appointed with the chairman of the Royal Agricultural Society, *K. Sehested*, Chamberlain, as chairman, appointed by the Society, and as members, *A. M. T. Westermann*, Professor at the Royal Agricultural College, representing the College, and the landed-proprietor, *M. Ahlmann* to Langholt, representing the Associated Danish Agricultural Societies, and having for its main object, for the present at least, to supervise the administration of the work in plant culture, the Royal Agricultural Society hereby yields to the honored Board the above-named administration, and at the same time states that the following are the Regulations for the position held and the work done by the Board, as drawn up under preparatory meetings of the various institutions interested in the work».

The above-named Regulations corresponded very closely to the proposal of the Ministry, (see pp. 141—142) but they united the Board more closely to the Society and hampered its freedom and independence more than *J. C. la Cour* who drew them up had foreseen. He had planned the entire organisation and was to have been chairman of the Board, but as he died on February 21, 1898, it was his successor as President of the Royal Agricultural Society, Chamberlain *K. Sehested*, — the first Danish Minister of Agriculture, — who became chair-

<sup>1)</sup> The name, Board of Plant Culture, (Statens Planteavl's Udvalg) was, on a proposal from Chamberlain *Sehested*, first used after the provincial Committees of Plant Culture of the Associated Danish Agricultural Societies were appointed, at the beginning of the century.

man and carried out the new organisation. He, indeed, differed in his view of the matter from the Captain on several points, and, authoritative as he was, his opinion was respected, or at all events accepted. Characteristic of the man is a marginal note which he wrote to a proposal that the chairmanship of the Royal Agricultural Society should authorize the Society's representative, that is to say the chairman of the Board, to act in its behalf, (see p. 142) » . . . . fortunately this has not yet been accepted, for by this measure the Royal Agricultural Society renounces all influence on the work of plant culture, at the same time retaining its responsibility as hitherto. The Society must remain the highest court of appeal, and the chairman of the Board must be able to refer differences of opinion to the chairmanship of the Royal Agricultural Society for decision. The Board is a superfluous institution, and to make such an institution all-powerful is senseless.«

It was inevitable that this point of view should, to a great extent, characterize the relation between the Board of Plant Culture and the Royal Agricultural Society, and it found expression in the following working plan for the Board, proposed by the Board (the Chairman), recommended by the chairmanship of the Royal Agricultural Society and passed by the Ministry of Agriculture, December 13, 1898:

#### Working-plan of the Board of Plant Culture.

##### 1.

The Board of Plant Culture consists of three members. One of these who is to act as chairman, is elected by the Phairmanship of the Royal Agricultural Society; one is appointed by the Director of the Royal Agricultural College after consultation with the Faculty of the College, and one is elected by the Associated Danish Agricultural Societies.

##### 2.

The members hold office for three years. On each January 1, the Royal Agricultural Society causes one member to be elected. The order of election is decided the first time by drawing lot. Members are eligible for re-election. Membership on the Board is un-salaried. The Board may secure salaried assistance.

##### 3.

The Royal Agricultural Society is the domicile of the daily work and the archives of the Board of Plant Culture. The annual accounts of the Board, which includes the time from April 1—March 31, are turned in to the Royal Agricultural Society whose treasurer is the treasurer of the Board. The treasurer may not, in behalf of the Board, pay nor receive any money without the written order of the Chairman.

##### 4.

The Royal Agricultural Society may, when opportunity presents itself, on agreement with the Board, call ordinary plant culture meetings to discuss ways and means for the work of plant culture.

Composition  
of the Board.

Relation to  
the Royal  
Agricultural  
Society.

5.

All communication of the Board of Plant Culture with the Ministry of Agriculture is through the Royal Agricultural Society.

6.

The Board is the direct supervisor of the work in plant culture; it is the superior of the directors of the experiment stations and gives them the necessary instructions.

Relation to  
the State  
Experiments  
in Plant  
Culture.

7.

A plan for running the stations and demonstrating the experimental results, made with funds from the experiment account and under the leadership of the directors, is drawn up annually by the directors of the experiment stations and sent by these to the Board before February 1. When this plan — with eventual modifications — has been approved by the Board, the directors of the experiment stations under the supervision of the Board, are fully responsible for running the stations and keeping within the account. In making moor cultivation experiments the Board should seek co-operation with the Danish Heath Society.

8.

The form under which the experiment material is recorded is determined by the Board after conferring with the directors of the experiment stations. The Board divides the material to be compiled between the directors, after conferring with these. The directors of the experiment stations are responsible for the correctness of the material and for its compilation.

9.

Decisions are made by the Board either by written vote or by open discussion at the meetings.

10.

The chairman of the Board calls and leads the meetings. It is his duty to see that the proposals passed are put into effect. Between the meetings the chairman attends to current business and reports at the following meeting on what he has done.

11.

No decision can be made without the approval of at least two members. If a discussion arises as to whether or not a matter shall be referred to the Ministry for decision, the chairman has the deciding vote.

12.

The annual account of the experiment work is presented by the Board to the Royal Agricultural Society before June 15, the proposed budget before July 1.

13.

The Board prepares an annual report of the work done in plant culture and by every means in its power disseminates knowledge of the results gained.

14.

The Board appoints a secretary to take charge of all the office duties of the Board, except the duties of treasurer, subject to the order of the chair-

Paid  
assistance.

man, and to assist him in all current business. When so ordered, the secretary may represent the Board officially. The Board supplies the secretary with the necessary office help.

15.

Changes  
in the  
working-plan.

Repeal or change in the above working-plan can only be made with the sanction of the Ministry.

After this, the Board of Plant Culture was merely a committee appointed by the Royal Agricultural Society with the approval of the Ministry. Secretarial duties, office work and the archives were to remain in the hands of the Society and all communications of the Board to the Ministry were to pass through the Society. Its treasurer was the treasurer of the Board and made his report to the Society; the Society was to call the ordinary plant culture meetings. As a result, the preliminary secretarial duties for the Board were arranged after consultation between its chairman and the chairmanship of the Royal Agricultural Society, and for the time being, given to *N. P. Jensen* from the Bureau of Statistics, (now Receiver of the Public Revenues and Member of the Lower House), with the treasurer to render assistance.

From September 1, 1898, the position of secretary was finally given to *K. Dorph-Petersen* (see p. 29), an agricultural graduate, now Director of the State Seed Testing Station. Although it was not so stated, far less written, the intention with this appointment was to take the future leadership of the experimental work into account: this, together with the fact that the Working-Plan § 6, — in spite of the resolutions to the contrary passed the preceding year, — expressly stated that the Board of Plant Culture was the director of the experimental work, gave rise to much dissatisfaction with and distrust of the Board from the directors of the experiment stations and made it difficult for the Board to work with them. First, five years later, when, on a change of secretary, the directors of the experiment stations were assured that the secretary, who, was also the treasurer both for the Royal Agricultural Society and the Board of Plant Culture, *H. C. Larsen* (see p. 105), an agricultural graduate, not should be leader of the experiment work, relations became less strained and have in the years which followed been irreproachable.

The first larger problem taken up by the Board of Plant Culture was the ordering and leadership of moor cultivation; in this connection the open question of a joint plan for the number and location of the experiment stations and the way in which local field experiments were to be carried out, as well as the arrangement, compilation and publication of the experiment material, was also brought forward.

A very large experiment material from *P. Nielsen* was waiting to be compiled. In accordance with the working-plan, this was distributed among the experiment leaders. Much of this was soon published,

but only after 1905, when *E. Lindhard*, (see p. 6) an agricultural graduate, had entered the employ of the State Experimental Department in Plant Culture, — from 1904 as assistant to the Board, and from 1909 as *N. P. Nielsen's* successor at Tystofte, — was there plan or headway in the compilation or publication of the experimental results. As a necessary basis for this, the Board at once adopted a homogeneous form for book-keeping at all the experiment stations, while copies of the experiment records were sent each year to the office of the Board, there to be kept on file for use by the speakers in working up the material. The complete experimental reports, which from 1903 are numbered, though published in the official journal, are only printed in comparatively few copies intended for the advisers, teachers at agricultural schools and other agricultural leaders, but not for practical farmers in general. However, in order that the experimental results and their application could become known in as wide circles as possible, the Board prepared the publication of brief, popular communications which were sent to the daily press and technical journals. The first communication appeared on June 23, 1899, and this new form for publishing experimental results aroused much interest and appreciation.

The same can not be said about the work done by the Board in introducing rational principles in laying out and making the local fertilisation experiments of the agricultural societies, in which Professor *T. Westermann* was active. The Board sought and obtained a grant of 10,000 crowns annually on the budget of the State Experimental Department for Plant Culture for 1900—01, to be used for local field experiments and demonstration fields for the agricultural societies. These measures were not to detract from the State Experiment Stations, but they were to be approved by them and the work carried out under their control. The State Board of Plant Culture, which administered the grant, could, in order that the experiment results might be trustworthy, require that special regulations for planning and carrying out the experiments be adhered to before the agricultural societies could receive State subsidy. This plan won the approval of neither experiment directors nor agricultural societies, and after much opposition, especially in Jutland, it was given up. However as late as 1906, the Board continued its influence over the distribution and administration of the grant which increased very much in the course of years<sup>1)</sup>.

On the request of the Danish Heath Society, as soon as the Board of Plant Culture was established, it re-opened the discussions with the Moor Commission of the Heath Society on the question of co-operation in the work of moor cultivation experiments

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<sup>1)</sup> See further: *H. C. Larsen & L. P. M. Larsen: Tidsskrift for Planteavl.* 24. B. 1917. P. 137.

which had already been under consideration. The result was a ›Proposal for Regulating the Administration of the Moor Question‹, which won the approbation of the Heath Society, the Royal Agricultural Society and the Ministry of Agriculture. From now and henceforth, ›all experiments with moor and meadow, hitherto under the State and Heath Society are to be centralised under a single institution‹. In the summer of 1899 a representative committee was appointed, — the Associated Commission for the Cultivation of the Moors, comprising the State Board of Plant Culture, whose chairman was the chairman of the Commission and three members elected by the Heath Society, — and the work placed in its hands. Similar to the working-plan of the State Board of Plant Culture, the Associated Commission at once drew up a plan, based on a proposal of Professor *T. Westermann*, insuring a successive increase of the number of permanent State Experiment Stations. By this the country was divided, according to soil and climate, into 11 districts, each with one station for experiment and advisory work; later a detailed plan for experiments on moor and meadow was proposed, — moor cultivation experiments being included in the work of the stations. In this connection and also on Professor Westermann's initiative, the Associated Commission planned, and in 1902, began, a thorough investigation of the uncultivated moors in Jutland. For this, a sum of 2,000 crowns annually, was granted from the budget of the State Board of Plant Culture. This investigation formed the basis for the moor investigations already referred to (p. 136). After 1908 it was continued by the Heath Society.

The plans and experiments of the Associated Commission were only realised to a slight extent. Contrary to expectations the work did not further co-operation between the State Experiment in Plant Culture and the moor cultivation work of the Heath Society. In many matters the Associated Commission differed with the administration of the State Board of Plant Culture, which likewise included moor experiments in its work and granted money to them. As a result of its divided and ambiguous position the Associated Commission never won sympathy or understanding among the experiment leaders. Its existence was based on an idea, a mistake in organisation; it lacked a reason for existence. By mutual agreement it was dissolved by a ministerial decree of January 16, 1908.

Nor did the plan for establishing the 11 permanent experiment stations, — attractive though it seemed, — win sympathy in its first form. The intended number of stations was reached in the course of years, but in another way, with other intentions, as what follows will show.

#### **New Experiment Stations Established.**

The demand and desire for an increased number of permanent stations had everywhere and constantly been raised by the agricultural societies and associations, especially the Associated Danish

Agricultural Societies. The first increase made in the period which we are discussing was, however, largely due to the Royal Agricultural Society. Its Malt-Barley and Wheat Commission had decided to abandon its experiments from the spring of 1903. The reason given was that the problems dealt with in experiments in cultivation of barley and wheat are greatly simplified, progress has brought to pass that the cultivation value, under our domestic conditions, of the different varieties almost wholly depends on the quantitative yield, — whereas quality played an important part earlier. The Society requested the State Board of Plant Culture to continue the work in the way and to that extent which seems most advisable and on the proposal of the Board, the State grant in question, 8,000 crowns annually, was retained and transferred to the State Experimental Department for Plant Culture to be used for: Cultivation of controlled seed; Gratis distribution of seed of good strains of seed varieties; Extension of the work in the improvement of strains of cultivated agricultural plants at the stations at Tystofte and Lyngby; Continuation of the comparative cultivation experiments with different varieties of wheat and barley which are always on sale as seed, and whose yield should be taken as a guide for the farmers.

For the latter object it was decided to rent a small area on Lolland or Falster where the best wheat and barley land of the country is found. As, at the same time the Associated Agricultural Societies of Lolland-Falster had established Aged Experiment Station in Plant Culture on Lolland, where work in improvement of strain was done, and greatly desired to combine State experiments with this, an arrangement was made with the Association, whereby from April 1, 1903, an experiment area of about 1.7 ha of the heavy loamy soil of the experiment station was rented for a period of years for this object, and at the same time the manager of the station, *H. A. B. Vestergaard* (see p. 33), an agricultural graduate, appointed to lead the State experiments. The experiments were to include barley, wheat, sugar beets, and other cultivated plants especially adapted to cultivation on heavy soil. The management of the station was placed under the supervision of the Tystofte Station and the expenses computed at 1,000 crowns annually, of which 700 crowns were to be paid as salary to the manager.

At the same time as this station was established, the Agricultural Society of Bornholm was very active in its efforts to have a similar branch station established on Bornholm under the supervision of the Lyngby Station. Soil, and even more particularly climatic conditions, are so different on this remote island from those in other parts of Denmark, that results gained from the other stations can hardly be applied there. Already in 1902 the Society began, with money raised for the purpose, to make experiments with different varieties and times for sowing as a guide for the farmers. However,

without State aid, it was impossible in the long run to continue this work satisfactorily. Through the State Adviser for the Islands, *K. Hansen*, Leader of the Experiment Station at Lyngby, who, in his work as Adviser, had felt the want of reliable experiment results from Bornholm, the Bornholm Agricultural Society brought about, that in the autumn of 1903, the State Board of Plant Culture sent to the Ministry of Agriculture a detailed and well-grounded plan for the establishment of an experiment area on the Island, with a grant of 1,000 crowns once for all for buildings and enclosures, and a sum of 1,500 crowns annually for carrying out the experiments. The adviser appointed to the Society was to lead the experiments. The plan was proposed too late for the grant to be given that fiscal year, but from April 1, 1905, the sum was obtained, and the experiment area at Aakirkeby laid out on about 1.7 ha very loamy soil of the original experiment field. The station at Lyngby was given supervision of the work and the grant placed on the budget of that station.

As early as 1899, when the plan for increasing the number of permanent stations was forward, the State Board of Plant Culture had expressed to the Ministry the desirability of establishing a station on Funen, where the conditions for plant culture differed from those in Jutland and Sealand. The Patriotic Society of Funen, which, at that time, represented the Associated Agricultural Societies of Funen, and was greatly interested in the matter, undertook to find a suitable place for a station. In reference to this, the following year the Board proposed that the Budget for 1901—02 should contain a grant of 59,000 crowns for establishing a station on 18 ha loamy soil near Ryslinge. It appeared however, that the inhabitants of Funen were not pleased with this location, and the proposition was rejected in the Parliament. Later on, the Ministry of Agriculture, through the Royal Agricultural Society, requested the State Board of Plant Culture to discuss with the Patriotic Society of Funen the most desirable location for a station, and to make a plan for its establishment, so that the question might be forward when the Budget for 1902—03 was drawn up. A committee of 11 representatives of the Provincial Organisation and the Board was appointed, ten available farms on the Island of Funen were visited, of these, three were examined carefully, samples of the soil tested every 65 metres, the depth of the loamy surface soil measured, the surface and sub-soil described. The result was to recommend establishing an experiment station on an area of 17 ha loamy soil of a farm near Aarslev and to apply for a sum of 61,400 crowns for the purpose. However, not even then, did the proposal bear fruit, — the Ministry believed that the time was not yet ripe.

When the matter had been made the subject of a renewed discussion, at the close of 1903, the Ministry of Agriculture informed the Royal Agricultural Society that it was the intention, on the

Budget for the fiscal year 1905—06, to seek funds sufficient for establishing an experiment station on Funen, but under the condition that the new station, when established, would take up other problems for solution than those with which the present stations, especially Tystofte, were engaged. When mention is made of Tystofte in this connection, it is because conditions of soil and climate on Sealand and Funen are so similar, that it does not seem reasonable to take up the same experiments at both stations. The Patriotic Society, in cooperation with the Associated Agricultural Societies of Funen, was requested to present a detailed plan of the problems which the new station would investigate in order to decide whether, under the given circumstances, it seemed best to seek funds for the establishment of the station. The State Board of Plant Culture was called upon to prepare the matter and discuss the question with the Associated Agricultural Societies, — these very exhaustive discussions lasted through the winter of 1904. It was decided that the station should deal with the following questions: Experiments with cultivation of plants for trade and seed culture; experiments with the procurement of stable manure, its storage and application and preparation of the soil; experiments, which from their very nature, ought to be found at all the stations. Which problem was considered the most important was not stated that time. When the Ministry had received a detailed account of the importance and scope of the work, the State Board of Plant Culture was authorized, after further discussion with the Associated Agricultural Societies, to present the final proposition as to the location of the station and the grant for its establishment. It was then resolved to locate the station on the farm near Aarslev, found in 1901, and comprising 17 ha land, which was to be purchased and supplemented by two adjacent areas, a total of 16 ha which were to be leased for a long period, with State pre-emption. The work at the station was to deal with the problems described above, but in such a way that experiments with stable and liquid manure were to be given the greatest attention. In erecting buildings on the property this object must be kept in view, as well as that of housing the chemical and soil-bacteriological investigations to be connected with the experiments in storing and applying the manure.

A sum total of 99,000 crowns was sought for establishing the station; of this, 27,000 crowns were intended for purchasing the 17 ha land, 37,500 crowns for buildings, 17,400 for live stock, implements and machinery, 6,000 crowns for instruments and apparatus, preparatory bacteriological investigations and wages to a laboratory assistant, and 2,400 crowns annually as salary to the director of the experiment station. The grant was given on the Budget for 1905—06, and the Station at Aarslev built during the summer of 1905. From April 1, 1905 *N. A. Hansen* (see p. 37), an agricultural graduate, was appointed leader of the experiments and director of the station. This

man had been *P. Nielsen's* assistant at Tystofte, but was now instructor at Dalum Agricultural School. For many years he had experimented with liquid manure and done all in his power to further the establishment of a station where these and like experiments should form the main problem. His wishes were now fulfilled.

The question of a station in central and western Jutland came up for the first time in 1899, in connection with plans for establishing the 11 permanent experiment stations. However, it was not until 1901, when 4 agricultural societies of central Jutland petitioned the Ministry of Agriculture to establish a station near Herning, that the matter was brought under consideration. The petition was sent to the State Board of Plant Culture which recommended it, but the Ministry of Agriculture allowed it to rest. In the beginning of 1904, however, the Co-operative Agricultural Societies of the Ringkøbing County sent, through the Associated Agricultural Societies of Jutland, a detailed and well-grounded petition to the Parliament for the establishment of an experiment station for west and central Jutland and requested the State Board of Plant Culture to give it its support. This it did in a communication to the Ministry of Agriculture of February 5, 1904, in which we read:

„ . . . that the conditions of plant culture in the district under discussion, which includes ca. 5700 km<sup>2</sup>, differ so greatly from other parts of Denmark, that the results gained at the experiment stations for plant culture already established, are only by exception applicable. The soils, which are light, poor, sandy, heath soils, often with bad drainage conditions, are the poorest in Denmark, and are not represented at any of the experiment stations at present established. Climatic conditions too, present peculiarities which are extremely important for the development of plant culture. As a result, the working conditions in these districts, so little favoured by nature, must be very different from those found in other parts of the country.

There are many special problems waiting to be solved which can only be made the subject of investigations at a permanent experiment station located in the district in question, and where there are soils characteristic of this. Therefore, taking these facts into consideration, the State Board of Plant Culture believes that it is very advisable to establish an Experiment Station for Plant Culture in Central and West Jutland, and warmly recommends the accompanying petition to the Ministry of Agriculture, urging that as soon as conditions permit, the necessary means for establishing and running such a station be granted on the State Budget.

At this time funds had been promised for establishing the station on Funen, so the Ministry of Agriculture did not feel justified in requesting a grant for a station in Jutland. The following year however, the question came up in Parliament under a Budget debate, and on February 10, 1905, the State Board of Plant Culture received through the Royal Agricultural Society a request from the Ministry of Agriculture, — in view of the fact that there seems to be an intense wish in west Jutland to have the question settled as soon as may be,

— and after further discussion with the institutions interested, — to propose ways for arranging the matter as advantageously and quickly as possible, so that the necessary funds may be granted on the Budget for the fiscal year, 1906—07. The State Board of Plant Culture therefore appointed a committee on preparative arrangements, composed of three representatives for the Associated Agricultural Societies of the Ringkøbing County, one representative for the Joint Commission for Cultivating the Moors, the State Adviser in Plant Culture for Jutland, and the Secretary of the Board of Plant Culture. In the spring of 1905, this committee examined 42 available farms in the districts in question, to find areas with soils typical of these, — heterogeneous, and well-adapted to experimental purposes. Among the light, poor, sandy soils, corresponding to the great stretches of sandy heaths in central Jutland, thorough investigations were made, in a similar way as on Funen, of the homogeneity and nature of the 3 areas which seemed best adapted, as well as of 3 of the better sandy loam soils of west Jutland. The result was that the Board of Plant Culture recommended locating the experiment station on 45 ha poor, sandy soil near Studsgaard in central Jutland, supplemented by 15 ha good, sandy loam soil near Borris in west Jutland, and by 22 ha, high peat bog of the Knude Moor near Herning and 11 ha low peat bog of the meadows of Gelleruplund near Herning. The proposal was drawn up and presented to representatives for the Agricultural Societies of Central and Western Jutland, the Associated Agricultural Societies of Jutland, the Danish Heath Society and members of Parliament from the districts in question. The final choice of areas for moor culture experiments was postponed until further investigations had been made of the low peat bogs and meadows in central and western Jutland. In order to carry out the plan as reasonably as possible, ordinary farm buildings were not constructed, nor were the areas purchased outright. A partnership was to replace ownership, the station was to lease the property for a long period of years with pre-emption, paying a fixed sum annually, corresponding to the interest and amortization of the purchase price and ordinary building expenses, while the actual experiment buildings, live-stock, tools, implements, etc., were to be paid for by the State.

Besides experiments in moor cultivation, the Station was to take up the following problems: Experiments with the conservation and application of stable and liquid manure and the preparation of the soil in connection with similar experiments on good soil at the experiment station on Funen; experiments with rotation of crops, including rational cultivation of nitrogenous plants, such as green manure and fodder crops; experiments with potato cultivation and grass cultivation; experiments with lime and marl; demonstration and observation of the effect of planting lee-belts, as well as a series of experiments common to all the experiment stations.

On this basis the State Board of Plant Culture on July 15, 1905, sent a communication to the Ministry of Agriculture recommending the establishment of the station and the granting of a sum of 49,000 crowns for the purpose. Of this, 35,600 crowns were for the Station at Studsgaard using 18,600 crowns for the experiment buildings, 14,000 for live stock, implements and tools, 3,000 crowns for instruments and apparatus in the laboratory; 4,400 crowns for the work at Borris including barns, etc; 9,000 crowns for rent and running expenses and 2,400 crowns annually as salary for the director. The grant was given on the Budget for the fiscal year 1906—07 and the Experiment Station at Studsgaard and the experiment area at Borris established in the summer of 1906. In the spring of 1909, when the investigation was finished, the Moor Experiments at Herning were established. From April 1, 1906 *N. J. Nielsen* (see p. 39), an agricultural graduate, and for many years assistant at Tystofte and Askov Experimental Stations, was appointed leader of experiments and director of this very comprehensive station.

Even before the new experiment stations were established, it was only too evident that many conditions at the old stations were unsatisfactory. The soil had not been chosen with sufficient care and with sole attention to its homogeneity and typical nature, — in certain cases the actual working conditions were bad. The soils at the station at Vester Hassing were rather heterogeneous, and the location of the station, exposed as it was to severe storms, was very unfortunate. Good typical areas of moor soil were lacking. On the proposal of the director it was decided that when the 10 years lease of the property had expired, the station should be moved to a more suitable locality, further west, near the Great Moor (Store Vildmose). In the summer of 1903, with this plan in view, the Associated Commission for Cultivating the Moors, together with the director, made preparatory investigations and designated some farms which were tested the following year in the usual way. The result was a proposal to lease for an experiment station, Østergaard Farm at Tylstrup with its 37 ha homogeneous, deep, mild, sandy loam, typical of the cultivated soils of Vendsyssel; 37 ha low peat bog of the Tylstrup meadows and 52 ha adjacent bog of the Great Moor. The proposal met the approval of the Agricultural Societies of Vendsyssel and the members of Parliament of the district. On the Budget for the fiscal year, 1905—06, was a grant for moving the station and 2,500 crowns for preparatory work at Østergaard, on the Budget for 1906—07, 9,100 crowns for taking possession of the new station, of which 4,000 crowns were to be used for changes and enlargement of the buildings on the moor and for enclosures. The Experiment Station at Tylstrup was then established and began its work from April 1, 1906; at the same time preparations were made for the moor experiments at Tylstrup.

Proprietary rights and working conditions at Tylstrup. Just as at Askov, the director was the leasee of the property. He placed the necessary area at the disposal of the experiment work for a certain sum annually. Horses and stable manure for working the experiment fields were furnished in return for the crops, and labour was provided at a fixed price. This very complicated arrangement which dated from the early days of experiment activity could be used as long as the work was on a small scale, but became very difficult and unsatisfactory, both for the director and the State Experimental Department when large areas and much labour were required. From April 1, 1907, with the sanction of the Ministry of Agriculture, a reform was made in the management of Askov and Tylstrup so that the station, or the State, took a lease of the property or properties on which the experiments were made, together with buildings, live-stock, tools and implements with pre-emption, and managed the station at its own expense. The cost of running, after the sources of income were subtracted, was no greater, but the unfortunate combination of public and private management, which had given the director an economic interest in the work, was avoided, and greater balance and freedom introduced.

In describing the agricultural experiment stations, account must be taken of the fact that in the course of years the area of the Experiment Station in Lyngby was enlarged many times by renting adjacent pieces of ground belonging to four different owners. This scattering of the experiment area, made the management difficult and expensive. It was therefore decided from April 1, 1911, to lease Virumgaard near Lyngby with 47 ha loamy soil, small parts of which had been rented for experimental purposes. No increase in the grant was necessary for this step. A few years later an opportunity arose for purchasing the property for a total of 135,000 crowns and the transaction was arranged by a special legal provision of May 29, 1914. At the same time State Adviser, *K. Hansen* resigned his position as director of the station, and from April 1, 1914, *J. C. Larsen* (see p. 43), an agricultural graduate, who for many years had been his assistant, was appointed in his place. At Askov, too, the areas had been increased to give room for enlarging the experiments. In 1906 the experiments on loamy soil were supplemented with 5 ha and from a nearby farm, Lundgaard, small areas of poor sandy soil, corresponding to large stretches of soil in southern Jutland were acquired as supplements to the experiments on sandy soil. From April 1, 1916 the station leased this entire property, together with a neighboring farm, in all 52 ha for a long period of years with preemption, the intention being to close the experiments on the little sandy field, as has now been done. Furthermore, the moor-property, Fossevengen, near Tylstrup, was purchased by the station on April 1, 1918, for a pre-emption price of 65,400 crowns, and the buildings enlarged during the fiscal year 1920-21,

for an extra sum of 114,000 crowns. On April 1, 1923, the State purchased the land leased to the Station at Aarslev for a pre-emption price of 28,500 crowns, and it is the intention after April 1, 1925, to make use of the pre-emption right to the clay field at Askov and the sandy field at Tylstrup.

Wishes for further increase in the number of agricultural experiment stations which have been expressed from time to time, — from east Jutland (the Randers district) from Thy and Sundeved, for instance, — have not been granted. The Ministry of Agriculture, the State Board of Plant Culture and the directors of the experiment stations believe that we are now supplied with a sufficient number of permanent experiment stations, well distributed throughout the country and in all respects fitted for solving satisfactorily the problems entrusted to them.

In the meantime development has continued, and eight years ago the scope and field of the State Experimental Department was enlarged by the annexation of the horticultural experiments. These had earlier been under the supervision of the Horticultural Societies, in very recent years of the Agricultural Societies of the West Ribe District and the Small-holders Societies of Funen. However the experiments made by the Horticultural Societies, especially those of the Islands which received a comparatively large State grant, were often subject to criticism. For this reason in 1911 the Associated Agricultural Societies of Funen appointed a 'Commission on the Establishment of a Horticultural Experiment Station on Funen'. At the meeting of the delegates from the Agricultural Societies of Funen in the autumn of 1912, this commission criticised severely the experiment work of the Horticultural Societies of the Islands, and in view of this fact, on October 25 of the same year, sent a communication to the Ministry of Agriculture requesting that funds be granted for establishing one or more Horticultural Experiment Stations to be placed under the supervision of the State Board of Plant Culture. An Experiment Committee representing the Horticultural Societies, the Danish Gardeners Society and the Agricultural Society of the Ribe District supported the plan, and the Associated Danish Horticultural Societies declared to the Ministry that the 'way in which experiments in economic horticulture were made at present, revealed such defects that a rational reorganisation of the experiments, in accordance with the principles on which the Experiment Work of the State Board of Plant Culture are conducted, is an urgent necessity and will be of the greatest advantage for horticulturists and gardeners.'

The Ministry of Agriculture which sympathized with the plan, wrote on April 30, 1913, requesting the Board of Plant Culture to state whether, with the above as a basis, it seemed desirable and expedient to attempt to bring about such an ordering, and if so, to draw up an outline of the best way in which it could be done. On June 28,

1913, the State Board of Plant Culture sent the following communication in reply to the Ministry:

»Horticultural experiments with State subsidy have been made for many years in various parts of the country under the supervision of the Royal Danish Horticultural Society, the Horticultural Society of Jutland, the Horticultural Society of the Islands and the Agricultural Societies of the West Ribe District, while during the present year the Associated Small-holders Society of Funen have begun to make horticultural experiments on a small scale.

Facts seem to indicate however, that these societies and associations make experiments according to their own plans without co-operation with other branches of the work, and therefore the experiment results reached are more limited in their scope and application than the case would be had they been made in co-operation or consultation with other institutions.

A rational, permanent experiment work, whose results give the certain, and dependable information necessary for practical plant culture, must, in the opinion of the Board of Plant Culture, be carried out under the direction of a general plan, common to the entire country, which, while considering the permanence of certain experiment series, likewise takes into consideration different conditions of soil and climate and the nature and importance of various experiment problems, — some being solved satisfactorily by experiments confined to a single locality, while others, in order to give complete information, require experiments carried out simultaneously at many places and under various conditions, but according to a single plan, — some experiments need only to be made for a very few years, others must be continued for a long series of years before the results are trustworthy.

There is no doubt but that Denmark possesses splendid natural conditions for the development of a rational and remunerative horticulture, which, both as an independent source of livelihood as well as a branch of agriculture, will increase with the increased number of small-holdings, consumption of fresh garden products and improvement in the conditions of their transportation and sale. However, with these conditions present, it is just as evident that, like agriculture, horticulture, to be developed rationally and remuneratively, must be founded upon an experiment work that is so supervised, planned and carried out, that its results afford real assistance in the cultivation of useful plants, — the choice of those varieties which satisfy in respect to quantity, quality and durability —, effective treatment of the soil, — fertilising, sowing, planting —, treatment under growth —, thinning, pruning, storage, etc.

The State Board of Plant Culture agrees therefore with the Associated Danish Horticultural Societies that the forms, under which experiments in the domain of applied horticulture are made at present, reveal so many grave defects that the proposed reorganisation, not alone seems desirable, but absolutely necessary as a basis for an up-to-date development of horticulture in Denmark. In consideration of the importance of the part which a rational organisation of horticultural work will presumably play, not alone for horticulture but also, and by no means least, for the small agriculturist, and too, in consideration of the unanimity with which the desire to place horticultural

experiments under the experiment work in soil and plant culture supervised by the Board, is expressed by all the institutions interested in the matter, the Board of Plant Culture will grant the wish, provided that the organisation, supervision and administration of the work can be done on the following lines.«

These main lines were: that only stationary experiments should be placed under the State Experimental Department — local experiments were to continue under the supervision of private institutions; that the stationary experiments were to be confined to economic or agricultural horticulture, — that is to say, to orchard and truck gardening, — the cultivation of flowers and hot-house plants was disregarded; that two permanent experiment stations for horticulture were to be established, one for the Islands and one for Jutland (possibly later on, with branch stations under various conditions of soil and climate) organised and led in the same way as the agricultural experiment stations; that the institutions for scientific investigations under the State Experimental Department assist the horticultural experiments in the same way as the agricultural experiments; that the State funds, hitherto granted to the Horticultural Societies for experiments, be transferred to the horticultural experiment stations for running expenses, while the Societies have the same rights to State subsidy for local experiments as the Agricultural Organisations have; that the plans for the horticultural experiments be made, approved and carried out, according to the same regulations as the plans for the agricultural experiments, and that the reports and summaries of experimental results take their place in the series of publications from the State Experimental Department beside the other reports, and published in the official journal, »Tidsskrift for Landbrugets Planteavl«, whose name is now changed to »Tidsskrift for Planteavl«.

On the request of the Ministry of Agriculture, this plan was subjected to a thorough discussion at a meeting held January 14, 1914, of the State Board of Plant Culture, the directors of the experiment stations, representatives for the Associated Danish Horticultural Societies, the Danish Gardeners Society, the Associated Danish Small-holders Societies and the Associated Danish Agricultural Societies, and was accepted as a basis for a plan for the establishment of the experiment stations. In the meantime, the associations expressed the wish for a fuller representation on the State Board of Plant Culture than at present, where horticulture and the small-holders were not represented. The State Board of Plant Culture did not share this wish, and was reluctant, as were the directors of the experiment stations, to enlarge a field of experiment work, already comprehensive, well-organised, and running smoothly and efficiently. However, in consideration of the benefit the farmers of the country were expected to derive from the change, they agreed. At the meeting, a Joint Committee on Preparatory Arrangements was appointed, on which was one repre-

sentative for each of the four main organisations, two experiment leaders, the State Adviser in Fruit Culture, the Horticultural Expert of the Agricultural Societies of the West Ribe District, and the Secretary of the Board of Plant Culture; the object of the committee was, after investigations had been made, and with the original, approved plan as a basis, to send a communication to the State Board of Plant Culture in regard to the farms chosen for the permanent horticultural experiment stations, the problems to be solved at each, the management, and other questions.

In this matter, the Committee on Preparatory Arrangements worked as had previous committees, — 85 farms were investigated in those districts of the country where it was desired to have the experiment stations established, 45 in north Jutland, (in South Jutland the location was given), 22 on Funen, and 18 in south Sealand and Falster. The committee proposed purchasing for the main station in Jutland the experiment areas in Spangsbjerg and many other places near Esbjerg, — in all 28 ha good sandy loam, hitherto used by the Agricultural Societies of the West Ribe District for experiments, — and for the main branch station, Svenstrupgaard near Hornum in the Himmerland district, 33 ha sandy loam, and later, if possible, another branch station in east Jutland, and as main station for the Islands, Blangstedgaard, near Odense, with 56 ha good loamy soil, and for a branch station possibly 22 ha of Fjernhøjgaard, near Præstø, and finally a branch station near Copenhagen to deal with special horticultural problems, those applied to kitchen garden plants, for instance.

The most important problems to be investigated by the stations were: variety experiments with fruit trees, fruit bushes and kitchen garden products, — the different varieties to be prepared by special plantings for observation; experiments and investigations in conditions of pollination and variation; fertilization and treatment of the soil; intermediate cultures; pruning and other cultivation methods applied to fruit trees and bushes; experiments and investigations in storage, packing, transmission, as well as preparation of fruit; experiments in plant breeding, effect of lee-belts; and chemical and phyto-pathological investigations.

After the State Board of Plant Culture had visited the farms under consideration the proposal was accepted with the revision that the station at Spangsbjerg, a remote district of the country, and which very evidently would not have been chosen as station had not the Agricultural Societies already established good stationary experiment work there, was not to be the main station, and that the branch station near Præstø be rejected for the present in favour of a station in the very best fruit district in the southernmost parts of the country. On July 7, 1914, the Board proposed to the Ministry of Agriculture that the following year a main station should be established at Blangsted, where the property should be purchased (172,930 crowns)

and two branch stations in Jutland, one at Spangsbjerg, where land and buildings were to be leased (36,910 crowns), and one near Hornum where the property was to be purchased (82,000 crowns). For this, a total grant of 291,840 crowns was required. The outbreak of the World War and the resulting difficult economic conditions prevented this sum from being granted on the Budget for 1915-16. The Board of Plant Culture then changed the basis of the proposition and the properties in question instead of being purchased outright were leased for a period of 40 years with partnerships as intermediary, the State retaining the right and duty of purchasing the property within the period for the sums offered. At the same time the new installations and running expenses were cut down as much as possible. The necessary grants were hereby reduced as follows: to Blangsted to 11,165 crowns, of which 8,865 crowns were for the lease, 17,800 crowns running expenses (income 20,000 crowns), assistance 1,500 crowns and salary to the director 3,000 crowns, — to Spangsbjerg, to 11,052 crowns, of which 3,452 crowns were for the lease, 12,600 crowns running expenses (income 9,200 crowns), 4,200 for salary and paid assistance, — and to Hornum to 4,900 crowns of which 3,400 crowns were for the lease, — giving a sum total for all three stations of only 27,117 crowns, plus a small sum annually on the budget of the State Board of Plant Culture for administration.

This proposition was approved by the Ministry of Agriculture and passed by the Parliament, and the required grant placed on the Budget for the fiscal year 1915-16, with the provision that the branch station at Hornum was not to be established before the following year. The Experiment Station at Blangsted and the Branch Station at Spangsbjerg were established in the spring of 1915, and the Branch Station at Hornum in the spring of 1916. *Niels Esbjerg* (see p. 48), an agricultural graduate, and the Horticultural Specialist to the Agricultural Societies of the West Ribe District was appointed leader of the experiments, Director of the Station at Blangsted and supervisor of the branch stations from April 1, 1915, and *Edv. Christiansen*, (see p. 49) a horticultural graduate, formerly assistant to the Horticultural Specialist, was appointed Manager of the Spangsbjerg Station from the same date. On April 1, 1919, the Station at Spangsbjerg was made an independent experiment station and the manager made Experiment Leader and Director of the Station. On April 1, 1920, the Hornum Station, which hitherto had been managed by an assistant, was likewise made independent and *Hakon Sørensen*, (see p. 51) former assistant under the Horticultural Experiments of the Ribe District, and later Manager of the Horticultural Farm of the Horticultural Society of Jutland in Hørning appointed Experiment Leader and Director of the Station.

During the years immediately following the establishment of the Horticultural Experiment Stations, grants were made for paying

interest and for the amortizations of loans, used for very considerable enlargements and improvements of the stations. In 1916-17 new buildings were constructed at the Spangsbjerg Station for a sum of 58,000 crowns, and the buildings at the other stations, at Blangsted in particular, were repaired and fitted out for use in the experiment work. A cold storage plant for fruit was installed at Blangsted in 1917 and a plant for the artificial irrigation of field and garden crops in 1920, at a total cost of 48,000 crowns. In 1923 the station at Hornum was also given an irrigation plant. Mention must also be made that steps have been taken for laying out a large observation plantation of fruit varieties. This is to make the selection of fruit varieties adapted to the conditions prevalent here in Denmark easier and cheaper than it is with actual experiments. On a special Bill of May 6, 1921, was a grant of 20,000 crowns to be paid annually for ten years for laying out and running such a plantation. However, as there is a difference of opinion as to whether the plantation should be located near Copenhagen, there to serve as a Pomological Central and Horticultural Experiment Station, or on the State property, Rønhave on Als in the best fruit districts of the country, nothing has as yet been decided.

On April 1, 1918, in connection with the Agricultural Experiment Stations a special department, the State Experiments in Weeds, was organised. Its object, in co-operation with the other divisions of the State Experimental Department for Plant Culture and the local experiments, was to make experiments and investigations in weeds and the means for their eradication. An annual sum of 6,000 crowns was granted for this purpose, and a small area from the Experiment Station at Lyngby placed at its disposal. *K. Hansen* was made leader of the experiments and will continue the work until a man has been found who will devote his life's work to this problem, so very important in a country like Denmark.

From April 1, 1923, a new division of the State Experimental Department replaces the Ambulatory Root Crop Experiments, — the State Marsh Experiments. In the autumn of 1921 the Co-operative Agricultural Society of North Slesvig asked the State Board of Plant Culture whether the State Experimental Department would include in its work thorough investigations and experiments in bettering the conditions of the loamy marsh soils of Southern Jutland, which, in proportion to their excellent natural condition, give a very small yield. Experiments of this nature, which must be run for a series of years, can not be made satisfactorily by the Agricultural Societies. The State Board of Plant Culture recognised the need of experimental investigations, a need which is common to all the marsh pastures of southern Jutland, and to several high and low lands used for permanent pasture in west and north Jutland. After a committee, comprising the experiment leaders, a representative for the

Co-operative Agricultural Societies, and the Danish Heath Society — which latter has made experiments of like nature, had expressed approval of the matter, on July 1, 1922, the State Board of Plant Culture, in a communication to the Ministry of Agriculture, requested that on the Budget of 1923—24 funds might be granted for appointing an experiment leader and for the work preparatory to laying out experiments on rented areas, of 5 to 10 ha of each of the three great marsh districts in south western Jutland, so that simple practical problems, ready to hand, might be solved quickly and cheaply without establishing a permanent experiment station equipped for research work in the marshes. The sum, 10,000 crowns, was granted and from April 1, 1923, *C. J. Christensen* (see p. 53), former leader of the moor-experiments at Herning, which are now being very greatly restricted, was appointed to lead the work.

From April 1, 1922, the State Board of Plant Culture has assumed the administration of the State Agricultural Experiments of the Faroe Islands, which, with the co-operation of the State Advisers on Plant Culture, were established in 1920, but hitherto under the supervision of the Ministry of Justice which appointed a commission to lead the work. These Agricultural Experiments comprise the Experiment Station at Højvig, near Thorshavn, owned by the State and with a home-field (Bó) of 9 ha soil, rich in humus, on a loamy sub-soil, and half the yield of a distant-field (Hauge) of about 10 km<sup>2</sup> with grazing for about 450 sheep, with smaller experiment areas on some of the other islands, as well as Sheep-breeding Experiments in Kvalvig, with a distant-field of about 5 km<sup>2</sup> with grazing for about 170 sheep. On August 1, 1920, *Ejnar Knudsen* (see p. 54), an agricultural graduate, former Assistant at the Lyngby Experiment Station and Manager of the Experiment Field at Aakirkeby, was appointed Leader of the Agricultural Experiments of the Faroe Islands and Director of the Experiment Station at Højvig. The Agricultural Commission of the Faroe Islands, which is now appointed by the Ministry of Agriculture, and comprises five members, of which one is appointed by the State Board of Plant Culture, is consultative on the Agricultural Experiments of the Faroe Islands, and, through the representative for the State Board of Plant Culture, may introduce propositions and suggestions in regard to ways and means for carrying out the experiments. The administration, which acts similarly to that of the State Experimental Department for Plant Culture, is under the sole direction of the State Board of Plant Culture, which is responsible to the Ministry of Agriculture. The annual grant of about 40,000 crowns is a special item on that Budget.

Finally note must be made of the fact that on *L. Helweg's* death in 1920, the Ambulatory Root-crop Experiments were brought to an end in their original form. The greater part of these experiments are now continued at the permanent experiment stations under the

designation, State Experiments with Root-Crops, with the chairman for the Experiments in Strains of Root-crops as leader of the work.

#### Scientific Institutions Founded.

It has always been acknowledged that scientific research in connection with practical experiments are a necessary condition for obtaining the required thorough and trustworthy results of experiment work. This acknowledgement was in reality what lay behind the propositions brought forward by the Commission on the Foundation of a State Institution for Scientific Research and Experiments in the Service of Agriculture, appointed in 1876 by the Ministry of the Interior and which led to the founding of the Laboratory of Agricultural Research of the Royal Veterinary and Agricultural College in 1883. According to the plan this laboratory was to deal with three branches of scientific study: agricultural chemistry, animal physiology and plant physiology, and with this end in view the Laboratory of Agricultural Research comprised three independent departments. However, only the first, the chemical department, was founded immediately, later the department of animal physiology was added, while the department of plant physiology, which was made the subject of renewed discussion by *N. J. Fjord*, lecturer at the college, in connection with the work of the Commission of the Royal Agricultural College of 1887, was disregarded. This was largely because in the meantime a chair of plant physiology has been founded at the University of Copenhagen and a position as lecturer and adviser in plant diseases at the Royal Agricultural College, as well as an independent comprehensive experiment department in plant culture, under which such a laboratory naturally belonged.

In November 1898, *Hjalmar Jensen*, M. Sc. proposed that the State Board of Plant Culture should use its influence in establishing a Laboratory of Chemical Research, — if possible with rooms at the Laboratory of Agricultural Research, — for studying the bacteria living in stable manure and soils and their influence on the storage, application and effect of manure, as well as for making cultures of the nodule bacteria of leguminous plants for practical and experimental purposes. In the meantime, *N. J. Fjord* had died, and the Laboratory of Agricultural Research did not wish to establish any such connection with the Experimental Department for Plant Culture. The State Board of Plant Culture considered, however, that it was its duty to further the establishment of such a laboratory, perhaps to also include a department for plant diseases, and in the summer of 1899, on the request of the chairman of the Board, Chamberlain *K. Sehested*, *F. Kølpin Ravn*, M. Sc., then assistant in plant pathology at the Royal Agricultural College, drew up, in behalf of *Hjalmar Jensen* and himself, a plan for the establishment and maintenance of an *Agricultural*

*Bacteriological and Phytopathological Laboratory*, which, for the present at least, should be housed in a temporary building and hot-house on the College campus, and later become a permanent department under the State Experimental Department for Plant Culture.

Of the plan for this laboratory, in which the work was to be divided between two mutually related departments, the bacteriological and the phytopathological, under the management of *Hjalmar Jensen* and *F. Kølpin Ravn* respectively, the State Board of Plant Culture, in a communication to the Ministry of July 14, 1899, concerning a grant (21,100 crowns) for the purpose, wrote as follows: ... »whereas the plant physiological investigations, for the present at least, are to be made with special attention to the *bacteriological* conditions of soil, manure, plant nutrition, etc., complicated and important questions in the economic treatment and application of fertilisers, for instance; the *phytopathological* investigations aim to make observations and experiments in the field, to observe the course of plant diseases, the conditions affecting their appearance, the harm done, and tests of the economic value of various remedies before these are applied in practical work, while the actual question of the causes of the phytopathological conditions and the best ways of preventing or overcoming these is solved by painstaking research work in the laboratory.« At the same time the Board emphasized the desirability of granting funds as soon as possible for making ordinary chemical analyses connected with the experiments in plant culture on a large scale, for hitherto such experiments had been made at private laboratories at very great expense.

The Ministry did not, however, consider the present moment auspicious for seeking the required funds for the laboratory, and the same view was held when the Royal Agricultural Society again brought up the question, this time in 1905 on Professor Stein's death and in connection with very comprehensive plans for the establishment of the General State Laboratory. However, after 1904, by degrees each of the permanent experiment stations was equipped with *small chemical laboratories* and a special assistant appointed to make simple chemical analyses in direct relation to the experiments. It was hereby acknowledged that there was a constantly increasing disproportion between the number and scope of cultivation experiments and the chemical investigations connected with these, and that at such small experiment station laboratories many and better tests could be made at smaller expense than at private laboratories. This point of view was strongly asserted in 1905 when the Station at Aarslev was established to make experiments with the procurement, storage and application of stable manure. Here, not only chemical but bacteriological examinations were required and a grant for the purpose was also given (see p. 151). On April 1, 1905, *Harald R. Christensen* (see p. 59), an agricultural graduate, and assistant at the Askov Experi-

ment Station, was appointed to make these important investigations. Until the Aarslev Station was completed and the laboratory equipped, *Harald R. Christensen*, who had previously pursued special studies fitting him for the work, was to do preparatory bacteriological research work at the Plant Physiological Laboratory of the Royal Agricultural College and at the same time continue his training. It was soon apparent, however, that these investigations could be made much better in Copenhagen where all the necessary means of assistance were at hand, and as the problems included experiments with stable manure and soil treatment from the stations at Aarslev, Studsgaard and Askov, it was but natural to centralize the work at the capital. The grant for the investigations, 2,000 crowns annually which was to be used for *Harald R. Christensen's* salary alone, was withdrawn from the grant to the Aarslev Station, and placed on a special account on the Budget for 1906—07: Agricultural Chemical and Bacteriological Investigations which later formed the point of departure for the establishment of the

**State Laboratory for Plant Culture.** The independent, thorough, research work done by *Harald R. Christensen* from the very first in this new and very important division of the Danish State Experimental Department formed the technical basis for the establishment of the Laboratory. For four years, until 1909, he worked under very modest conditions, in a room placed at his disposal by the Royal Agricultural College. In a communication to the Ministry of Agriculture of July 14, 1908, the State Board of Plant Culture called attention to the fact that now, since the aforementioned experiments are to be made at the various experiment stations during the coming year, and the investigations led by *Harald R. Christensen* carried out in their full extent, it is necessary to provide special rooms for the assistant, fitted and equipped with the required instruments and apparatus for research work, and to grant a small sum annually for the supplies, chemicals, gas, fuel, travelling expenses to those stations where samples are drawn, and supervision of the investigations, and the Board therefore proposes that on the Budget for 1909—10 a total of 3,700 crowns be granted to be used as follows: 700 crowns for rent, 750 crowns for furnishings, 1,950 crowns for purchasing instruments, apparatus, etc., and 300 crowns travelling expenses. The salary paid the leader remained unchanged at 2,000 crowns, making a total of 5,700 crowns. This sum was granted, a flat with three rooms and a kitchen at Henrik Steffensvej 4, Copenhagen, V, rented, and during the spring of 1909, the State Laboratory for Plant Culture installed and *Harald R. Christensen* appointed manager. The following year his salary was raised and a sum granted for extra help, — after April 1, 1912, a permanent scientific assistant, — to make the chemical investigations, while he himself took charge of the bacteriological tests, research work on the micro-biological conditions of various soils, and their

effect on the value of these as cultivated soil. The study of stable manure which had been one of the main motives in establishing the Laboratory was given less attention.

At that time the question of the lime-requirement of various soils was the object of many investigations at the Experiment Stations and in the Agricultural Societies, and this led *Harald R. Christensen* in 1910 to work out a method for a biological determination of the lime-requirement of soils (azotobacter-test), a subject which he had touched upon in 1906. The reliable accurate measurements of this method afford a simple, cheap way of obtaining exact information on the reaction and basicity of the soil, and due to the astonishing development of the entire lime-requirement problem it has obtained a very large practical application. The laboratory was not, however, equipped for mass-investigations so the matter was discussed in a committee appointed in 1911 by the Royal Agricultural Society to bring about co-operation between various institutions doing research work in soils, and an agreement reached whereby »Denmark's Geological Investigations«, with a special grant for the purpose and with technical assistance from the State Laboratory for Plant Culture, was, from 1912, enabled to make and receive payment for making lime-requirement tests of soil samples sent in through the Agricultural Societies.

Another very important practical side of the work which had been on the program of the Laboratory from the start, — bacteria cultures for leguminous plants, especially lucerne, — was now taken up. The first cultures used in farming were sent in 1910 to a farm of the Tranekær domain, Langeland, to be used on 22 ha with lucerne. During the years immediately following, the demand for bacteria cultures for lucerne increased to so great an extent that it necessitated an increase in laboratory space and in the staff of assistants at that time of the year when the cultures are made. From the spring of 1916 the flat adjoining the Laboratory which the manager had used for a dwelling was taken over for laboratory purposes. However the work increased so greatly that in a year the lack of space was again felt as much as ever. Though the Laboratory made no effort to advertise the fact that it sold bacteria cultures for inoculating lucerne seed, the demand among the farmers increased enormously, — in the spring of 1918 cultures were sent to about 2,400 consumers, sufficient for an area of 2,000 ha. The income for this was over 12,000 crowns; in other words more than the total State subsidy to the Laboratory.

The question of erecting a building for the State Laboratory for Plant Culture had been discussed many times, but had now become urgent. The difficulties in equipping an ordinary dwelling flat, quite aside from the matter of space, were very large. The scientific investigations on which the entire work rested could not be made satisfactorily under present conditions. The department for lime-requirement investigations, which had been placed temporarily under Den-

mark's Geological Investigations had likewise grown, about 14,000 tests were being made annually giving an income about equal to that from the department for bacteria cultures. The intention had been that these two departments, each serving practical agriculture, should maintain mutual economic independence, and in obtaining a grant for erecting a laboratory building it was very fortunate that funds for the actual running expenses of said laboratory were already available. The moment for seeking the grant seemed propitious, unemployment due to war conditions was very prevalent, and the Government hoped that State building enterprises on a large scale would better these conditions. By a bill of March 19, 1918, the buildings of the Royal Veterinary and Agricultural College and the State Seed Testing Station were to be enlarged. The Director of the College had agreed to place an area of about 1,000 m<sup>2</sup> of the College campus, near Dr. Abildgaard's Avenue at the disposal of the Laboratory and allow the actual building construction to be supervised by the special Building Commission, recently appointed.

On January 3, 1919, the State Board of Plant Culture proposed to the Ministry that under the third debate on the Budget for 1919—1920, a sum of 86,660 crowns,—based on figures from 1914,—be granted for constructing a three storey laboratory building with a ground area of 242 m<sup>2</sup>. The plan was drawn by the architect for the College in consultation with the Manager of the Laboratory and the Board of Plant Culture. The proposition was accepted by the Ministry and Parliament and the funds granted. Under discussions of the building plans it was discovered that an elevated track with heavy traffic was projected built adjacent to the grounds. It seemed then, unwarrantable to locate the laboratory there, as the traffic would hinder and complicate the work, especially microscopy and fine weighing.

During the very extensive discussions and investigations which now followed to find a suitable ground for the Laboratory, it was generally agreed that it was best to locate it on the College grounds, thus furthering co-operation between the College and allied institutions, for the various agronomical scientific institutions have many mutual interests. The State Board of Plant Culture thought that the demonstration field at the corner of Bülowsvej and Rolighedsvvej was especially well adapted for the Laboratory, but for some uncertain reason the College authorities, supported by the Building Commission, were opposed to this, and through the Ministry, designated 1,000 m<sup>2</sup> ground of the property belonging to the Home for the Infirm near the Ladegaard Brook. This the Board accepted until further investigation and discussion proved that this low-lying, restricted property, which necessitated the construction of a bridge across the brook, was very ill-adapted to laboratory purposes, and as, meanwhile, much time had been consumed with these fruitless discussions and the work done by the Laboratory increased still further in scope, making it impera-

tive that the building, for which funds had already been granted, be constructed immediately, the Board decided to break off connection with the College and locate the Laboratory on an area of 1 ha of the land of Virumgaard of the Lyngby Experiment Station. In a communication to the Ministry of November 22, 1920, the Board wrote as follows:

When the Board, in its communication of January 3, last year, proposed that the building designated to house the State Laboratory for Plant Culture be located on the grounds of the Royal Agricultural College, and the actual work of construction placed under the supervision of the College Building Commission, it did so in order that this new building, like the new State Seed Testing Station, might, in a natural way, form part of the enlargement of the College buildings, and that co-operation or association between the Laboratory and instruction in agricultural subjects be made closer.

The Royal Agricultural College has, however, considered co-operation of small value, as the very extensive discussions on finding a location for the Laboratory have revealed, see for instance the communication of June 12, of this year from the Director of the College to the Ministry, in which the Building Commission draws attention to the desirability of locating the Laboratory in Lyngby, where a building for the State Phytopathological Institute is at present under construction. The suggestion, to which reference is made in the communication from the Board of the 9th of this month, that laboratory practice for students of soil bacteriology might be given in the rooms of the State Laboratory for Plant Culture will, according to information given by the new representative of the College on the Board, Professor Fr. Weis, hardly be realised, and the Director of the College has not expressed the desire for any other form of co-operation between the two State institutions in question.

As, moreover, the ground designated for the Laboratory near the Ladegaard Brook, in the northwest corner of the garden of the Home for the Infirm for many reasons, — the question of eventual enlargement for instance, — seems less well-adapted to the purpose, and as the Manager of the Laboratory, who hitherto, on account of the difficulties of securing temporary assistance in the Laboratory when such is required, was extremely reluctant to have the laboratory constructed anywhere else than in the capital, now believes that these difficulties are not insurmountable, the State Board of Plant Culture has decided to lay aside its claim to the property offered by the Director of the Royal Agricultural College and let the building, which is to house the State Laboratory for Plant Culture, be constructed on ground belonging to the State-owned Virumgaard Farm of the Lyngby Experiment Station, located on Frederiksdalsvej near the building of the State Phytopathological Institute. A map on which the projected ground is indicated is enclosed (see p. 65).

In locating the building here, the Laboratory obtains more room, close relationship with practical farming, the Experiment Station and the Phytopathological Institute, — with the latter indeed, there is a possibility for closer co-operation and association in use of hot-houses, service, porter's lodge, etc. The rooms intended for the use of the manager of the sub-

department, R. K. Kristensen, who on account of co-operation with the Laboratory of Agricultural Research, will probably continue to live in Copenhagen, can be included in the laboratory rooms, so that for the present at least, there will be sufficient laboratory space if the building is designed according to the plan sent with the communication of January 3, last year. However this locality will necessitate, as was the case with the Phytopathological Institute, providing dwelling accommodations for the Director, as indicated further in the plan accompanying the communication of May 21, this year.

As a result of these changes and the more favourable building conditions in Lyngby, the Board believes that an edifice able to house all that is at present necessary for the work of the Laboratory can be constructed for the sum granted on the Budget of 1919—20, — the figures computed according to prices in 1914.

The sum, which, due to the increase in prices since 1914, will be lacking in order to complete the building, and which must be sought granted on the Budget for next year, or on the Additional Grant Budget of the present fiscal year, will be  $2\frac{1}{2}$  times as much as the sum already granted, or 216,650 crowns, making the total cost of construction 303,310 crowns, or about the same amount as was granted to the State Phytopathological Institute.

On December 23, 1920, after the Ministry, with this communication as a basis, had discussed the matter further with the College it authorised the State Board of Plant Culture to construct a building for the State Laboratory for Plant Culture in Lyngby on the ground designated. Prices and other conditions were such that it was possible to enlarge the plans for the building to cover a ground surface of 450 m<sup>2</sup>, about twice the size of the plan projected in 1918, and to equip the laboratory to satisfy the requirements made of it at every point. In the course of the next two years, 1921 and 1922, the building was constructed and the sum, 50,000 crowns for its equipment, granted. In January 1923 the new State Laboratory for Plant Culture was opened for work (see p. 60). At that time both the department for lime-requirement investigations from Denmark's Geological Investigations, where during the past 11 years, 166,000 soil samples had been tested, and the department for research work and bacteria cultures, now comprising an annual production of about 75,000 tubes (cultures enough for 12,500 ha) with an income of about 100,000 crowns were transferred to the new Laboratory. The permanent staff now included, 1 director, 1 manager of the sub-department, 4 scientifically trained assistants, 10 other assistants, and during the spring rush of work a large number of persons employed temporarily. The annual turn-over for the Laboratory is about 120,000 crowns, — of this only 10,000 crowns are granted by the State.

**The State Phytopathological Experiments.** Regular investigations and experiments with plant diseases and their control were already begun by *P. Nielsen* in the 70's of the last century. The results of his studies, which were made with State subsidy, contributed im-

portant data on the biology of parasitic fungi, especially the rusts and smuts. *E. Rostrup's* (see p. 67) pioneer work as phytopathologist, teacher of phytopathology at the Royal Agricultural College and as Consulting Specialist on Plant Diseases to the Ministry of Agriculture, from 1884 until his death in 1907, must also be mentioned here, even though this work was not experimental in the strictest sense of the term. However, experiment work in plant diseases was organised on a large scale by his successor, Professor *F. Kølpin Ravn* (see p. 68). As mentioned, p. 164, he sent to the State Board of Plant Culture in 1899, a plan for establishing a Phytopathological Laboratory combined with an Agricultural Biological Laboratory and working in connection with the field experiments with plant diseases made at the permanent experiment stations. In the communication of May 16, 1899, he begins as follows:

»When I, the undersigned, present a plan for establishing systematic investigations and experiments with the diseases of our cultivated plants and the means for their control, as part of our agricultural experiment work, I hardly need to point out the expediency or necessity of such a step. It is recognised everywhere, as the establishment of numerous phytopathological experiment stations and laboratories in Sweden, Germany, Holland, Roumania, Hungary, the United States of North America and Australia, in recent years bears witness. The idea of founding such an institution here in Denmark has been suggested many times, see for instance, Dr. E. Rostrup's paper, »Experiments already made, or which ought to be made, in order to discover the causes of plant diseases and means for their prevention«, read at the Agricultural Congress in Copenhagen, 1888, and State Adviser K. Hansen's remarks on the question in »Beretning om den landøkonomiske Konsulentvirksomhed« for 1896. As our agriculture constantly suffers considerable loss due to the diseases of cultivated plants, as many good remedies have been proposed which have not yet been tested here in Denmark, and as the rapid development of phytopathology craves experimental investigations to an ever increasing extent, the time seems ripe for seeking to put the plan into effect . . . .«

However a long time passed before a phytopathological laboratory was established. In this, as in so many other departments, a beginning had to be made from without, in practical agriculture and its organisations. Dr. *Ravn* soon realised this fact. At the beginning of the century, while he was assistant in phytopathology at the Royal Agricultural College he sought to establish co-operation with the Committees on Plant Culture of the Agricultural Societies of the Provinces, and in 1903 began investigations and preparatory experiments in the Jutland Associations with the special object of combatting »club-root fungus« (*Plasmodiophora brassicae*). The following year the work had assumed such shape and won such approbation that the Associated Danish Agricultural Societies petitioned the Ministry for money to appoint Dr. *Ravn* as experiment leader and specialist

in plant diseases under the Agricultural Societies, namely 2,000 crowns annually in salary, and 1,500 crowns for travelling expenses. The sum for the salary was granted and Dr. *Ravn* began his duties April 1, 1905, — the societies however, were to raise the funds necessary for travelling expenses, assistance, office-rent, experiments, etc. — a total of 1,500 crowns annually.

This new activity developed very quickly. This was due both to Dr. *Ravn's* splendid work and to the fact that in the summer of 1905 an insect pest did great damage to the cereal and root crop harvests, especially in Jutland. In the autumn resolutions were passed at the Delegate Meetings of the Agricultural Societies to express . . . .

»the desirability of seeking, by thorough comprehensive investigations and experiments, means for preventing similar dangers in the future, and warmly requesting the chairman to apply to the Ministry of Agriculture for the necessary funds for continuing and enlarging the experimental and advisory work in plant diseases and means for their prevention, begun under the Danish Agricultural Societies.«

With this end in view, the Associated Agricultural Societies at once petitioned the Ministry for further funds. The petition, which was drawn up by Dr. *Ravn*, aimed primarily at »securing suitable accommodations for housing the offices and laboratories of the experiment work (microscopic and other investigations of the samples of plants, soils, etc., sent in, studies on the mode of life of fungi and insects, chemical tests, etc.) as well as a store room for the archives and collections of diseased plants, noxious insects, parasitic fungi, etc.« For this purpose a four room apartment with kitchen on Forchhammersvej in Copenhagen was to be rented. Larger sums were to be granted for carrying out the »numerous local field experiments« and sending »specialists in plant diseases on journeys of investigation in various districts of the country at all seasons of the year.« The expenses were estimated at 8,740 crowns to be used at once and 12,400 crowns annually.

The State Board of Plant Culture received the petition from the Royal Agricultural Society and in behalf of the Society stated that . . .

»the Board, as well as the Associated Danish Agricultural Societies, considers it very desirable to establish systematic phytopathological and entomological research work for the benefit of cultivated agricultural plants. The loss sustained year by year through plant disease and noxious pests on the crops is so large that considerable State subsidy should be granted to work whose aim is to investigate the above named conditions and to secure means for preventing and curing disease.

However as the Associated Danish Agricultural Societies have petitioned the State to cover all the expenses entailed in such work, both the establishment of local experiments, investigations in various districts of the country, as well as research work in the laboratories and stationary experiments under the supervision of the Societies, the Royal Agricultural Society cannot

refrain from calling attention to the fact that such a method of procedure is not in accord with the principles according to which similar measures are usually established or supported by the State.

It is well-known that laboratory investigations and experiments in other domains of agronomy which depend solely on State subsidy are under the supervision of the State Experimental Department for Plant Culture and directed by that institution. The Royal Agricultural Society believes, that the same condition must prevail in this case . . . . .

The principle of these theories was endorsed by the Ministry, but the theories themselves were not put into effect immediately. Just at that time the Agricultural Societies renounced their claim to a State subsidy of 7,000 crowns annually, — for the »advancement of milking work«, for which »interest was on the decline«, — in favour of plant culture, so that it became possible to enlarge the grant for phytopathological investigations and experiments without coming into direct conflict with the regulations already enforced. The proposition was then modified and again brought before the State Board of Plant Culture which, on December 15, 1906, wrote as follows to the Ministry of Agriculture:

»In regard to the further organisation of the work, and according to the enclosed communication from Dr. *Kølpin Ravn*, it is proposed:

That field experiments and other local investigation in plant diseases be established under his leadership,

That Mrs. Sofie Rostrup, M. Sc., be associated with the work as zoological assistant with permanent salary and travelling expenses,

That rooms, furnishings, apparatus, books, etc., necessary for the work, be rented or procured,

That State subsidy be applied for and the work placed under the supervision of the Associated Danish Agricultural Societies.

The State Board of Plant Culture believes that the establishment of the investigations and experiments in question, will be of great aid in gaining information in regard to phytopathological conditions in the various parts of the country, and in finding measures for preventing plant diseases.

The Boards also recommends that Mrs. *Sofie Rostrup* (see p. 72), who possesses splendid qualities for assisting in the zoological department, and who has already rendered advisory assistance in that field, be permanently associated with the work, in order to secure the necessary technical aid.

The Board considers it expedient to rent suitable accommodations, purchase furnishings, apparatus, etc. in order to insure the best possible working conditions for microscopic investigations, making preparations, filing archives, office routine, etc. The Board approves the size of the sum calculated for the various items.

On the question of leadership of the work, and the acquisition of the necessary funds, the State Board of Plant Culture cannot refrain from calling attention to what is also to be deduced from the communication of the Royal Agricultural Society to the Ministry of Agriculture of March 22, last year, in regard to a petition from the Associated Danish Agricultural Socie-

ties for the enlargement of the grant to the work in question, that, under the proposed arrangement, according to which this experimental, investigative and advisory work, supported by State subsidy alone, is to be supervised by organisations of the Agricultural Societies, — the new division is not given the same position as the other divisions of the Experimental Department for Plant Culture, established and subsidised by the State, which, as is known, are associated with the State Experimental Department for Plant Culture and led by that institution.

Even though it must be acknowledged, in view of the way the activity has grown of late, especially since Dr. *Kølpin Ravn's* appointment as Advising Specialist to the Agricultural Societies, that it is only natural that the work of fighting plant diseases develop, for the present at least, under the supervision of the Agricultural Societies, and that all the expenses for said work be covered by the State, yet in carrying out the present proposition, the importance of the relation referred to above, should not be overlooked. There is the more reason for this caution, since the grant for carrying out the proposition cannot, in all probability, be given directly in connection with the grants already at the disposal of the Agricultural Societies for field experiments and demonstration fields, not only because these measures, as they are effectuated at present, cannot be co-ordinated with the phytopathological investigations and experiments conceived by Dr. *Ravn*, but also, and especially, because the former are conditioned by the Agricultural Societies, paying from their own funds a definite share of the expenses for which State subsidy can be given.

Moreover, even though the present proposition means a considerable advance and betterment of the conditions under which the fight against plant disease and noxious pests is being made at present, yet, in the opinion of the Board, this will not prove sufficient in the long run; sooner or later more comprehensive provisions for the work must be established, — a phytopathological laboratory with the necessary green-house, as has been proposed many times by the Royal Agricultural Society and the State Board of Plant Culture, — most recently in a communication to the Ministry from the Society of March 25, 1905, on the establishment of a State Laboratory to house the necessary departments of phytopathology and biology.

In view of this, it seems necessary once again to emphasize the fact that in establishing the phytopathological investigations and experiments proposed here, nothing must be done which can in any way interfere with a final felicitous solution of the State Laboratory problem; moreover an arrangement should be made whereby, at any time necessary, the work of combatting plant diseases can be partly or wholly withdrawn from the supervision of the Associated Danish Agricultural Societies and placed under that institution, where, in view of the conditions then prevailing, it most rightly belongs.

Hereupon, from April 1, 1907, the proposed change in the grant from 2,000 to 9,000 crowns annually went into effect. This enabled the Agricultural Societies to enlarge the phytopathological experiment and advisory work very considerably, — two permanent assistants or specialists, the zoologist, *Sofie Rostrup*, M. Sc. and the botanist, *M. L.*

*Mortensen*, M. Sc., were appointed, an experiment area (1 ha) and rooms in Lyngby secured and experiments laid out on a larger scale, all under direction of Dr. *F. Kølpin Ravn* who at that time, on the death of *E. Rostrup* received the appointments of Professor in Phytopathology at the Royal Agricultural College, and Consulting Specialist in Plant Diseases to the Ministry of Agriculture. His fee for the latter position, 2,000 crowns annually, replaced what he had received in salary as Leader of the Phytopathological Experiments. From April 1, 1910, the State subsidy for this work was increased with 3,000 crowns annually to be used for additional salary for the assistants, making the total annual State grant, 12,000 crowns, while the Agricultural Societies contributed 1,500 crowns annually from their funds to cover travelling expenses.

Parallel with the phytopathological work of the Agricultural Societies, the State Experiment Stations had also begun a series of experiments whose direct aim was the control of such diseases as club-root (*Plasmodiophora brassicae*), nematode infection, rust and others. In 1905, on the proposal of the State Board of Plant Culture, a special grant was placed at Dr. *Ravn's* disposal for research work in connection with these experiments, and with all the stationary experiments, which afforded a wealth of material for observing the appearance of diseases under varying conditions. From April 1, 1907, this grant was increased by 800 crowns annually for establishing experiments with causes of infection by the club-root parasite and means for its control on a special area (2.5 ha) at Studsgaard, and from April 1, 1911, by 1,000 crowns annually, for experiments with the control of clover nematode (*Tylenchus devastatrix*). The State subsidy for this work, also under Professor *Kølpin Ravn's* leadership, was 2,300 crowns annually.

*M. L. Mortensen's* death in 1911, furnished an occasion for discussing the question of leadership and administration of the now very extensive experiment and advisory work in phytopathology which was divided among various institutions, while, as is mentioned above, the Agricultural Societies benefitted by a special arrangement of the State subsidy. Plans were forward for reorganising the entire activity as an independent institution, enlarged to include horticultural phytopathology and administered by a special board. However, under discussions in a committee composed of representatives for the Experimental Department the following organisation plan was drawn up and on January 16, 1912, sent to the Ministry for the approval:

The Phytopathological Experimental and Advisory Department is to be divided. Stationary and ambulatory experiments and laboratory research work are to be placed under the supervision of the State Experimental Department for Plant Culture.

The Advisory Department in connection with local experiments is to remain under the supervision of the Agricultural Societies and must abide

by the ordinary regulations for State subsidy to plant culture work. The 1,500 crowns granted annually by the Associated Danish Agricultural Societies are to be continued and used for the appointment of an adviser to the Agricultural Societies.

Stationary and ambulatory phytopathological experiments and investigations are to form an extension and continuation of the phytopathological work already existing under the State Board of Plant Culture. The work is to be organised as a special department, with Professor *Kølpin Ravn* as experiment leader, assisted by a botanist and zoologist and later an agronomist specially trained for the experiment work.

The Phytopathological Department, like the other divisions under the State Experimental Department for Plant Culture, aims to give guidance and instruction to agriculture. Should it be so desired, the Phytopathological Department will, as far as the time and means of its staff permit, give similar guidance to horticulture.

Professor *Kølpin Ravn's* salary as State Consulting Specialist in Phytopathology covers his work as Experiment Leader. Expenses entailed for salary and inspections tours of the botanist and zoologist, rent of laboratory and office rooms, and running expenses connected with the experiments are to be covered by the sum, 12,000 crowns annually, granted by the State and now transferred to the budget of the State Experimental Department for Plant Culture.

This reorganisation is to be placed on the budget for the fiscal year 1913—14, which is to be ready in June 1912, and to go into effect April 1, 1913.

When the State Board of Plant Culture which had received the proposition for discussion, had declared its willingness to assume the administration of this work, it became, after April 1, 1913, a special department of the State Experimental Department for Plant Culture with Professor *F. Kølpin Ravn* as director and with a total annual grant of 14,300 crowns, of which 5,000 crowns were to be used as salary for the botanist and zoologist, 1,400 for rent of experiment areas and laboratory rooms, 4,500 for experiments and investigations and 3,400 crowns for travelling and office expenses. In the years immediately following, the phytopathological investigation and extension work, a heritage from the Agricultural Societies, whose comprehensive advisory and experimental activity had given it a solid foundation, was so well organised and systematised that the new institution, the State Phytopathological Experimental Department, won much confidence and appreciation, first among the farmers, later among the gardeners.

However the conditions under which the work was done were far from satisfactory. Ordinary stationary experiments and field observations were relegated to the little old experiment area at the Lyngby Experiment Station, the laboratory (two rooms) for the botanist and assistant rented temporarily in a villa in Lyngby, that for the zoologist on Paludan Müllersvej in Copenhagen and for the Director in the Phytopathological Department of the Royal Agricultural College in Copenhagen. It must be acknowledged that this scattering

of the work rendered co-operation between the members of the staff and inspection of the experiments difficult, while under such primitive laboratory conditions many important investigations had to be postponed. Experiments with diseases of horticultural plants required large areas, as did other problems demanding constant inspection and careful investigation.

A satisfactory arrangement could be reached only by assembling all office and laboratory work in a single locality closely connected with field investigations. Lack of building made it impossible to find the required accommodations in Lyngby. No other way lay open than to construct a suitable edifice to house the necessary laboratories, offices and equipment on an area able to room both the stationary experiments and experiments with cultivated agricultural and horticultural plants. On a proposition from the State Board of Plant Culture of October 31, 1918, a piece of ground (Dronningens Vænge), of the orchard of Sorgenfri Castle, Lyngby, which was especially well adapted to the purpose, was transferred by the Ministry of the Interior to the State Experiment Work from the spring of 1920. At the same time, May 6, 1919, the Ministry of Agriculture authorised the Board to place the necessary sum for constructing the projected building to house the offices and laboratory of the State Phytopathological Experimental Department on the said area, for which a plan and estimate are requested, on the draught of the budget of the State Experimental Department on the fiscal year 1920—21.«

In collaboration with Professor *Kølpin Ravn*, who on April 1, 1919, had resigned the leadership of the Phytopathological Experimental Department and become member of the State Board of Plant Culture, the plans for the new Institute were drawn up by the experimenter leader in June, 1919, and approved as a basis for the grant. The building, which has three storeys, with a ground area of 280 m<sup>2</sup> was estimated at 240,000 crowns, half of which sum was granted on the budget of the fiscal year 1920—21. Contracting, which was made a year later, showed an increase in the estimated cost of 64,500 crowns, giving a total estimate of 304,500 crowns. On July 23, 1920, the Ministry of Agriculture gave its sanction to constructing the building according to the contract, and the sum lacking, 184,500 crowns, was granted the following year. During 1920—21 the Institute was built and equipped with furnishings, instruments, apparatus, etc., for a sum of 62,000 crowns, and at the beginning of 1922 was ready for use (see p. 74).

Before Professor *F. Kølpin Ravn* resigned his leadership of the State Phytopathological Experimental Department, he reorganised the work to include three sub-departments, each with an independent leader, — the *botanical department*, under the Director himself, the *zoological department* and the *department for extension work*. The two former comprise research work, the actual experiments and investigations hitherto under the botanist and zoologist, and deal with the

Total Experiment Area, Size of Staff of and State Grant to the State Experimental Department for Plant Culture from the Founding of the Institution until April 1924.

Fiscal year	Area ha	Size of staff				State grant	
		Experiment leaders	Managers of Departments	Assistants	Total	Ordinary (running expenses)	Extraordinary (establishment of new institutions)
1880—1881	3.5	1		1	2	Crowns	Crowns
1881—1882	3.5	1		1	2		
1882—1883	3.5	1		1	2	3000	
1883—1884	3.5	1		1	2	3000	
1884—1885	3.5	1		1	2	3000	
1885—1886	5.4	1	1	2	4	10000	
1886—1887	16	1	1	2	4	10000	5000
1887—1888	18	1	1	2	2	10000	
1888—1889	23	1	1	3	5	10000	
1889—1890	23	1	1	3	5	13500	1500
1890—1891	30	1	1	3	5	13500	
1891—1892	34	1	1	3	5	13500	
1892—1893	34	1	1	3	5	13500	
1893—1894	54	4		5	9	27100	
1894—1895	67	5		6	11	32200	
1895—1896	68	5		6	11	32200	
1896—1897	82	5		7	12	43000	
1897—1898	82	5		7	12	43000	
1898—1899	85	5		7	13 <sup>1)</sup>	46000	6500
1899—1900	85	5		7	13	46000	51000
1900—1901	85	5		8	14	51500	1915
1901—1902	88	5		8	14	52600	3825
1902—1903	90	5		8	14	56020	1850
1903—1904	92	5	1	11	18	71320	4139
1904—1905	92	5	1	14	21	74170	
1905—1906	132	7	2	15	25	83770	97100
1906—1907	297	8	2	20	31	108360	45720
1907—1908	300	8	2	22	33	120788	3067
1908—1909	300	8	2	24	35	126388	500
1909—1910	303	9	2	24	36	156878	24207
1910—1911	336	9	2	25	37	165758	11414
1911—1912	377	9	2	26	38	176308	6800
1912—1913	381	9	2	26	38	180278	1500
1913—1914	382	9	5	27	42	204780	17554
1914—1915	382	9	5	28	43	205910	104166
1915—1916	492	10	6	31	48	234277	20318
1916—1917	525	10	7	31	50 <sup>2)</sup>	264692	
1917—1918	602	10	9	30	51	288887	15648
1918—1919	602	11	9	34	56	369466	68373
1919—1920	602	11	9	34	56	590216	104946
1920—1921	610	14 <sup>3)</sup>	8	37	61	729988	337950
1921—1922	624	13	12 <sup>3)</sup>	41	68	736179 <sup>4)</sup>	511163 <sup>4)</sup>
1922—1923	624	13	13	42	70	846685	52115
1923—1924	616	13	11	39	65	643385	58700
						6911103	1556970

8.47 Mill. crowns.

<sup>1)</sup> Here and in subsequent years the Secretary of the State Board of Plant Culture (Chief of Bureau) is included. <sup>2)</sup> Here and in subsequent years the head clerk at the Bureau for Plant Culture is included. <sup>3)</sup> 1 experiment leader and 2 department managers of the agricultural experiments of the Faroe Islands. <sup>4)</sup> Here and in subsequent years the grants to the agricultural experiments of the Faroe Islands are included.

appearance and spread of plant diseases and the measures to be taken for their control, while the extension department, using the results of the other two departments as a basis, at courses and meetings, by sending out printed and written instructions and by procuring material for expositions and demonstration-fields, etc., supports the agricultural and horticultural organisations, especially the advisers in plant culture, in their work of locating and controlling disease. This department is to do the work done hitherto by the State Consulting Specialist to the Ministry of Agriculture, which position, on Professor *F. Kølpin Ravn's* death in 1920, was not filled.

When the new building and experiment area were taken into use, the State Phytopathological Institute employed a staff of 8 persons, — 1 director of the experiments, 2 managers of the sub-departments, 4 assistants, and 1 janitor, besides temporary assistants, — and received an annual grant of 50,000 crowns.

Mention must also be made of a temporary change made in 1923, whereby the lecture and demonstration hall of the Institute, intended for courses of study, etc., is used by the extension department, while the chemical laboratory is placed at the disposal of the State Investigations with Fodder Crops. This department, which was established in 1911, is based solely on the work of the manager, *R. K. Kristensen* (see p. 77). It comprises chemical and technical investigations, made largely in connection with the State Experiments with Animal Husbandry, (Laboratory of Agricultural Research) and deals with experiment problems which can only be solved satisfactorily by co-operation between the two State institutions.

As a matter for comparison we note that aside from similar grants to the Danish Heath Society, the State loans to the local experiments and advisory work in plant culture under the Agricultural and Horticultural Organisations until 1924, amounts to a total of about 5,000,000 crowns, while the organisations themselves have contributed just as large a sum, making a total which is actually more than the sum granted to the State Experimental Department for Plant Culture.

#### **The Management and Administration of the State Experimental Department for Plant Culture.**

Those principles, which in 1898, when the State Board of Plant Culture was established, formed the basis of the organisation of the State Experiments in Plant Culture, and according to which the technical leadership of the work, hitherto centralised in one man, — *P. Nielsen*, — was to be decentralised and divided among the experiment leaders, each with his station and special problem, while the administration of the entire activity was to be centralised and given over to a board, the State Board of Plant Culture, representing the various institutions concerned, as is described in detail pp. 141–146, have been maintained and have stood the test of

years. That special organisation form for a State institution, not hitherto used in Denmark, — nor in other countries either, — has been recognised as sound and practicable and adopted in other departments of agriculture (the State Board of Animal Husbandry, the State Dairy Board, the State Board of Agricultural Implements and others).

The beginning was cautious indeed. The new form was introduced temporarily to be abandoned as soon as a single man could be found capable of uniting and mastering the technical leadership and the administration. Thus § 6, in the regulations of the State Board of Plant Culture (see p. 145), contrary to the wishes of the experiment leaders, reserves the right for the Board, in addition to its administrative duties, to maintain a kind of general technical leadership, or at any rate to establish such leadership when desirable or necessary. However no such necessity has ever arisen. The Board has never acted the part of ›direct leader‹ of the work of plant culture, and the man capable of assuming such leadership has never been found.

During the first ten years after its establishment the relation between the Board of Plant Culture and the Royal Agricultural Society was gradually modified so that the Board of Plant Culture was given more freedom and independence in its work than was expected when the regulations were drawn up. Its propositions and recommendations to the Ministry of Agriculture, which were despatched through the Royal Agricultural Society, were seldom discussed in that body but sent through unchanged. After some years had passed the Board communicated directly with the Ministry of Agriculture in all matters pertaining to the administration of the Experimental Department. After 1908 the annual report of the Board which had hitherto been presented at the general meeting of the Royal Agricultural Society and included in the annual report of the Society, was published separately. Treasury business was transferred from the Society; the office of the Board, *the State Bureau of Plant Culture*, had always been housed in the rooms of the Royal Agricultural Society, but when in 1903, the Society moved from the Anker Building, Ved Stranden 14, to the Denmark Building, Vester Boulevard 34 (see p. 81), it was given separate rooms and later, (1913 and 1918), reorganised and enlarged and a meeting-hall, room for records, etc., placed at its disposal, so that the independence of the Board was strengthened in this way too.

The actual administration decided upon when the Board was appointed, was no longer up-to-date. After the question of Changing and Renewing the Business Procedure had been discussed in the Ministry of Agriculture and in the Royal Agricultural Society again and again, on October 28, 1911, the State Board of Plant Culture presented through the Royal Agricultural Society a proposition in which we read as follows:

»After State Adviser P. Nielsen's death in 1897, the leadership of the Experimental Department, hitherto in P. Nielsen's hands, subject to the supervision of the Royal Agricultural Society, was, after discussion with various persons and institutions interested, regulated as follows: the Society, as hitherto, was to house the work of administration and the records, and to be responsible for the annual report of the treasurer while the actual work of administration was to be given to an acting committee, the Board of Plant Culture, which later, after the Agricultural Societies had likewise appointed boards of plant culture, came to be known as the »State Board of Plant Culture« — consisting of three members chosen by the Chairmanship of the Royal Agricultural Society, the Director of the Royal Agricultural College, in consultation with the Faculty of that institution, and the Associated Danish Agricultural Societies.

This arrangement, as the report on the discussions of the subject shows, was merely considered temporary and the possibility held in reserve that the leadership of the Experimental Department later, just as during P. Nielsen's life-time, could be entrusted to a single man. However for the present no one could be designated as willing or qualified to assume the position.

Nor was this possible later, and by degrees as the years passed and the administration of the work by a board proved satisfactory in all respects, the wish to carry out the original plan has gradually decreased.

On this account, and because of the considerable development in the State Experimental Department for Plant Culture of recent years, not only in actual scope and size of the budget, which has been increased four-fold, but in the plan and actual experiment work, the effective treatment and publication of the results, the entire administrative side of the activity, the conditions of tenure and running the experiment stations, the budget and accounts, etc., all of which have been revised and improved, and in order that uniform development along these same lines may continue, the State Board of Plant Culture desires to bring up to date and revise the regulations which originally formed the basis of the actions taken by the Board, but which are no longer satisfactory, so that they may again form the basis for the work.

While the regulations adopted in 1898 were drawn up with a special view to the Board and its activity, it seems natural now to enlarge their scope to include the leadership of the entire Experimental Department, and therefore the accompanying proposition embraces the entire Experimental Department in its aims.

Since, in the years which have passed, neither the experiment leaders nor the Board have seen any reason for wishing a change, the Board in drawing up the new regulations has endeavored to retain the main lines of the old, whereby the experiment leaders have full responsibility for drawing up plans for the experiments, carrying out the plans accepted, compiling experiment results, running the stations and keeping within the budget allowed, while the Board endorses the plans and the budgets, publishes the reports of the experiments and superintends the work.

Aside from certain details for leading the Experimental Department, which for the reasons cited above, it seems desirable to include in the new

regulations and which are therefore included in the plan, only the following changes are proposed:

1) The members of the State Board of Plant Culture are to be appointed by the Ministry of Agriculture after nomination by those institutions which have hitherto appointed them. The chairman of the Board is likewise appointed by the Ministry. The members of the Board hold office for three years.

This change, which is practically pro forma, is suggested in order to avoid the peculiar and not very felicitous arrangement whereby a Board which superintends so comprehensive and important a State institution as the State Board of Plant Culture, with an annual budget of about 180,000 crowns is largely appointed by private institutions. That form for appointment which was satisfactory so long as it was merely temporary is no longer up-to-date.

By the proposed change the mode of appointing both the Board and the Chairman will correspond to what is customary in other similar institutions, the State Seed Testing Station Commission, the State Forestry Experiments Commission and the Committee on the Danish Agricultural Museum.

2) As a result of the change, the State Board of Plant Culture will have closer dealings with the Ministry of Agriculture than hitherto, and the formal position which, under the old regulations the Royal Agricultural Society occupied as an intermediary between the Ministry and the Board and with responsibility for the accounts is now annulled. However, as what follows will show, this entails no actual change in the present business relation between the Board and the Society.

In the early days of the Board, — in accordance with the business procedure, — the accounts of the State Experimental Department as well as the propositions and proposals of the Board were sent to the Ministry through the Society, which acted upon the more important matters before sending them further. However, after a few years, this method, which was considered superfluous by the Chairmanship of the Society, was abandoned. For the past 8—10 years sending matters through the Royal Agricultural Society has been a mere formality, and in accordance with an understanding between the Society and the Ministry of Agriculture, the formality, which only serves to delay the work, has been set aside, so that all bills and propositions as well as the annual accounts are sent directly from the Board to the Ministry. The present proposal, then, brings no change in actual conditions at this point.

3) Treasurer's duties pertaining to the Board, which according to the former regulations, were entrusted to the treasurer of the Royal Agricultural Society, must, as a natural result of the present proposal, be given to the Secretary of the Board, but as both positions are at present, as is known, held by the same man, this transfer, too, is a formality only entailing the change that the salary for the treasurer, which may be correctly fixed at 400 crowns annually, be paid in the future by the Board instead of by the Society.

4) The business management and the archives will, as hitherto, be housed by the Royal Agricultural Society. This, however, is not obligatory, and there is no clause to that effect in the regulations.

The same holds true of the regulation whereby the Society, when occa-

sion offers, on agreement with the Board, may call general plant culture meetings to discuss questions of interest to the State Experiments in Plant Culture. Such meetings have never been called, and, according to the lines which the local State-subsidized plant culture work has followed since the establishment of the State Board of Plant Culture, it seems hardly probable that they will be called in the future. Should however occasion arise, the Society is empowered to call such meetings.«

Both the Society and the Royal Agricultural College agreed to every point in the proposal. The Agricultural Societies, however, did not wish, as proposed in § 1, to exchange their direct right of election to the Board for the right of nomination subject to approval by the Ministry, but preferred »to retain the present arrangement, until at some future date the entire matter is reorganised«. The Ministry deferred to this wish, and on May 4, 1912, approved the proposed regulations with the old provisions in § 1 practically unchanged.

Two years later, when it was decided to enlarge the State Experiment Work to include horticulture, the question of a corresponding enlargement of the State Board of Plant Culture was likewise raised, (see p. 158), but nothing was done until 1916 when new pressure was brought to bear on the question through the Associated Danish Small-holders Societies which petitioned the Ministry that the Societies might be represented on the Board. In a declaration to the Ministry of November 18, 1916, the Board expressed itself as follows:

»In the reorganisation of the Experimental Department as applied to horticulture, made in 1914, and which led to the stationary horticultural experiments being included in the State Experimental Department, the question of the extension or reorganisation of the Board was thoroughly discussed and diverse opinions expressed. However the discussions led to no result which warranted the Board's suggesting a change in its composition at that time. Both the organisations directly interested and the experiment leaders have expressed great approbation of the administrative work of the Board, especially in view of the growth and development in the Experimental Department during the past few years. That the administration has been so satisfactory is largely due to the fact that the Board consists of but three members, who in lieu of their position, without technical or political deviations, can further co-operation between State and local experiment work and between the experiment leaders and the various departments to the mutual satisfaction of all concerned.

For these and similar reasons the Board has believed it desirable to limit its numbers, thus making the administration simpler and the work easier and better. However, now that the Associated Danish Small-Holders Societies have expressed a wish to be represented by a member on the State Board of Plant Culture, and in view of the large number of farmers which these organisations represent, the Board must admit that the demand to be represented is but natural and just, especially in consideration of the fact that the Experimental Department now comprises economic horticulture which is, — or may become, — a matter of great importance for small-holdings. Yet,

and also in view of the horticultural experiments, the result of granting the wishes of the Small-Holders Associations is that the Horticultural Organisations, the Associated Horticultural Societies, and the General Association of Danish Gardeners must likewise be represented on the Board. Such representation may take place without increasing the membership of the Board, for two or several organisations may have one representative, and such an arrangement, affording the possibility of many combinations, has been discussed. The Board finally decided that a common representation for various organisations, even though these are closely related, — presents too many difficulties both in establishment and in actual work, and that the various interests are best served and the composition of the Board best balanced, enabling it to work with the greatest stability, when each main organisation is represented by one member on the Board whose total is not to exceed five members.

The advantages in this arrangement will doubtless counterbalance the difficulties resulting from increasing the number of members, but the Board wishes again to assert that in its opinion the greatest membership has now been reached if the Board is to continue to act satisfactorily in an administrative capacity.

In accordance with the above, the State Board of Plant Culture moves that:

1) The present Board be supplemented with two members, one to represent the Associated Danish Small-Holders Societies, and one to represent the Horticultural Associations.

2) The appointment of each of the five members of the Board is to be ratified by the Ministry of Agriculture on the proposal of the institutions represented, in the case of the present members by those institutions which now appoint members, and in the case of the new members by the Association of Danish Small-holders Societies and the Associated Danish Horticultural Societies respectively and after consultation with the Committee on Management of the General Association of Danish Gardeners. Each institution appoints one member. Members can hold office for five years.

Thus an attempt is made to depart from an arrangement, natural enough in the beginning, but now less correct, whereby a Board which supervises so comprehensive and important a State institution as the State Experimental Department for Plant Culture, with an annual budget of about 300,000 crowns is appointed by private institutions without ratification by the Ministry.

3) The chairman is chosen by the Ministry of Agriculture among the members of the Board. He holds office as long as his appointment as member lasts.

Until now the representative of the Royal Agricultural Society has been Chairman of the Board. The Society, in a communication presented earlier, renounces this position of preference in favour of the appointment by the Ministry.

4) The business procedure for the State Experimental Department, which at several points is at variance with the regulations of the Salary Bill of the Experimental Department of April 17, this year, is to be changed in accordance with the law and the present proposition.

A proposal for a new business procedure is enclosed.

The proposal was subscribed to by the Ministry, and the new business procedure sanctioned December 5, 1916. With the minor revisions from the State Officials Act of September 12, 1919, the business procedure regulations in its final form as approved by the Ministry of Agriculture September 7, 1920, is as follows:

**Business Procedure Regulations**  
of the State Experimental Department for Plant Culture.

## 1.

The State  
Board of  
Plant  
Culture.

The State Board of Plant Culture administers the joint experiments in plant culture. The Board consists of five members appointed by the Ministry of Agriculture, but nominated respectively by the Director of the Royal Agricultural College, in consultation with the Faculty of that institution, the Three-Man-Chairmanship of the Royal Agricultural Society, the Associated Danish Agricultural Societies, the Associated Danish Small-Holders Societies, and the Associated Danish Horticultural Societies in consultation with the Committee on Management of the General Association of Danish Gardeners.

Members hold office for five years. Each January 1, the Board causes the election of a new member. Membership is unsalaried.

The Ministry of Agriculture appoints one of the members as Chairman of the Board during his membership period.

## 2.

Matters pertaining to the Board are decided either by written vote or open discussion at the meetings.

It is the duty of the Chairman to call and lead the meetings and see that the decisions made by the Board are put into effect.

No decision can be made unless approved by a majority of three members. If the Board is divided as to whether or not a question should be sent to the Ministry of Agriculture for decision, the Chairman casts the deciding vote.

## 3.

The State  
Bureau of  
Plant  
Culture.

The Chief of Bureau, in addition to his secretarial duties, is responsible for the management of the Bureau of the State Board of Plant Culture, subject to the supervision of the Board. When so authorized he may represent the Board officially.

## 4.

Tidsskrift  
for  
Planteavl.

The Board publishes a periodical, »Tidsskrift for Planteavl«, which is the official organ of the Experimental Department. The editor of the periodical, usually the Chief of Bureau, is appointed by the Board.

In this periodical are published reports and announcements of the results of the Experimental Department as well as other matters pertaining to the cultivation of soil and plants.

## 5.

The  
Officials  
of the Ex-  
perimental  
Depart-  
ment.

The officials of the Experimental Department are engaged or permanently appointed, dismissed or pensioned, in accordance with the regulations of the State Officials Bill of September 12, 1919, in force at all times.

The State Board of Plant Culture is the immediate superior of the

directors of the experiment stations and laboratories and of the leaders of experiments and imparts to them the necessary instructions for the work.

## 6.

Under supervision of the State Board of Plant Culture, each director of an experiment station or laboratory, or leader of experiments is individually responsible for the management of his experiment station, laboratory or sub-department, and for keeping within the grant allowed. The experiment leader or director represents the station or department in all legal questions and is responsible for its claims or obligations at all times. With the approval of the Board he appoints or dismisses the permanent assistants necessary for the station or laboratory and determines their wage, in close accord with the corresponding items on the budget.

## 7.

Each manager of a sub-department is responsible for the management and work of his department subject to the supervision of the experiment leader or director in question.

## 8.

Each fiscal year a comprehensive common plan for the Experimental Department is drawn up. This plan contains detailed regulations for planning and carrying out the experiments and investigations to be made in the coming year.

Experi-  
ment  
plans.

The project for this common plan is drawn up annually by the directors of the stations and laboratories and the leaders of the experiments in common, and sent to the State Board of Plant Culture before February 1. When the project, — with eventual changes, — after discussion with the directors and leaders has been approved by the Board, the directors of the experiment stations and laboratories and the experiment leaders, subject to supervision by the Board, have full responsibility for carrying out the plan.

## 9.

The form in which the experiment material is registered is determined by the State Board of Plant Culture after discussion with the directors of the experiment stations. Each director sends annually to the Board a copy of the results of the experiments for the past year to be put on file in the archives of the Board.

Experi-  
ment  
results.

## 10.

On the proposal of the directors of the experiment stations, the State Board of Plant Culture appoints a speaker for each experiment series. It is the duty of this speaker, when the experiment series is complete, to compile the results and write a report.

The speaker, together with the directors of the stations or managers of the departments where the experiment series has been located, is responsible for the correctness of the material and the compilation. The speaker submits the report of the experiment series to the Board in that form in which it has been approved by the directors or leaders of the experiments in question. The brief announcements of the results of the experiment work are prepared in a similar way.

Officials of the Experimental Department in Plant Culture may not, on their own responsibility, in printed publications or lectures, make public the results of the State Experimental Department in Plant Culture.

## 11.

The  
Budget.

The projects for the annual budget for the separate stations, laboratories and departments are submitted to the State Board of Plant Culture by the respective directors, experiment leaders and managers. The Board then decides the extent as well as the projects to be included in the petition for the grant to the entire Experimental Department for the ensuing fiscal year. This petition must be sent to the Ministry of Agriculture before July 1.

## 12.

The  
Accounts.

The accounts of the Experimental Department for the preceding fiscal year must be drawn up and presented by the State Board of Plant Culture to the Ministry of Agriculture before June 15.

After these are revised the Board, the separate stations, laboratories and departments are informed and receipts for the bills sent.

## 13.

Co-  
operation.

The Experimental Department in Plant Culture seeks co-operation with other institutions and in those departments where such co-operations seems desirable.

## 14.

Repeal or change of the above regulations can only be made with the sanction of the Ministry of Agriculture.

By degrees, as years have passed and the leadership and administration assumed permanent regular forms, the wish arose to legalize the Experimental Department whose questions had hitherto been decided by resolutions from the Ministry of Agriculture alone. By this step the activity would attain recognition as a State institution and its officials be placed on an equal footing with other State officials. The salaries paid to the directors of the experiment stations had always been extremely modest. They were not granted according to any fixed rules, but whenever the Board or the Ministry deemed it necessary, they were increased by an extra sum on the budget for that purpose. This arrangement was very unsatisfactory, especially for the experiment leaders, and on their repeated and earnest requests, the State Board of Plant Culture in 1908 drew up a proposal for a Salary Bill for the experiment leaders similar to the Bill for State Advisers passed the same year. In commenting on the Bill the Board stated that it considered it extremely desirable to try to regulate once for all the salaries paid in the experiment work which has now become a permanent, indispensable part of agricultural organisation. A number of clever men occupy the positions of experiment leaders. These men are specially and thoroughly trained for the work; they are intimately acquainted with plant culture, experiments in plant cultivation, as well as with agricultural conditions in general. Their

responsible, conscientious, comprehensive work in managing their station, in planning and carrying out experiments, as well as the special advisory work in all matters pertaining to plant culture, which, to an ever increasing extent is required of them, within, as well as without, the domain of their own special station, is greatly valued by our agricultural population. These men are justified in demanding that the question of their salaries be decided in a Salary Bill by whose provisions they are entitled to a regular advance, a maximum salary, bearing a reasonable relation to the standard of living of to-day, and which, besides being a suitable recompense for the comprehensive and responsible work which they perform, gives them the right of pension for themselves and their widows. The Ministry recommended the Bill and presented it before the Lower House on January 8, 1909. It contained clauses to the effect that the number of the experiment leaders and the work of each should be decided on the Budget, their appointment and dismissal be determined by the Ministry of Agriculture, the annual salary of each be fixed at 2,400 crowns, increasing each fourth year with 300 crowns, until the maximum, 3,600 crowns was reached, that the right of pension and of widow's pension be granted under the same regulations as they are granted to other State officials in similar positions.

Due to an accident of chance, after the first reading in the Lower House, the Bill was referred to a committee and not again brought forward. In the years which followed, the repeated petitions from the State Board of Plant Culture to the Ministry of Agriculture to take up the matter were ignored for political reasons. The same fate was reserved for a proposal brought forward by the Board in 1913 for a Pension Bill for the Functionaries and Workmen Permanently Employed in the State Experimental Department for Plant Culture, even though at that time an Old Age Pension Committee was at work to revise the entire question of State pensions.

During all the time that these matters were under discussion, the Board was obliged to confine itself to an attempt to regulate and better the salaries of the functionaries through the Budget, and with the Bill of 1909 as a guide, was partially successful until war conditions caused demands for a far greater increase of salaries. Partially on this account, in the beginning of 1916, a Salary Bill for Officials of the Higher Institutions of Learning was presented before the Parliament. To the paragraph applying to the Royal Agricultural College a proposition was added in regard to the Laboratory of Agricultural Research, the Animal Serum Institute and the State Seed Testing Station, whose affairs had not hitherto been legalized. This seemed an unexpected and favourable moment for settling the long-delayed affairs of the State Experimental Department for Plant Culture which was just as needy and just as deserving an institution as the abovenamed, and the State Board of Plant Culture made the most

of the opportunity. A well-justified proposal was drawn up and sent to the Ministry of Agriculture on March 10, 1916, and the following day presented as an Amendment to the Bill on its second reading. It was passed and on April 17, 1916, the Salary Bill for the Royal Veterinary and Agricultural College, the Laboratory of Agricultural Research, the Animal Serum Institute, the State Seed Testing Station and the State Experimental Department for Plant Culture was signed by the King and became a law. According to this, the directors of the experiment stations were to be paid 4,000 crowns annually, with an increase of 400 crowns every fourth year, until a maximum of 5,600 crowns is reached; the directors of the laboratories 3,600 crowns annually, increasing, as above, to 4,800 crowns; the managers of sub-departments 3,000 crowns increasing to 4,400 crowns; the botanist and zoologist appointed to the phytopathological experiment department, 2,400 crowns, increasing to 4,000 crowns; permanent scientific assistants 2,000 crowns, increasing to 3,600 crowns; other assistants 1,600 crowns, increasing to 2,500 crowns; the chief of bureau 2,800 crowns increasing to 4,400 crowns; the head clerk 2,400 crowns, increasing to 4,000 crowns,— all with the right to old age and widow's pension, according to the usual regulations.

By the State Functionaries Bill of September 12, 1919, and on a proposal from the State Board of Plant Culture, the regulations were altered and supplemented at several points and the position of the State Experimental Department for Plant Culture and its equality with other State institutions thereby further established. However the Director of the State Laboratory for Plant Culture was first placed on equal terms with other directors of laboratories on the enlargement of the laboratory and its removal to Lyngby. Aside from the general regulations applicable to all State officials, the section of the Law of September 12, 1919, applying to the Experimental Department reads as follows:

*Section 24: e) The State Experimental Department for Plant Culture.*

§ 1071.

Experiment leaders and directors of experiment stations and laboratories are to receive 5,400 crowns annually, with an increase of 600 crowns every third year, until a maximum salary of 7,200 crowns is reached.

§ 1072.

The managers of sub-departments are to receive 4,500 crowns annually, with an increase of 600 crowns every third year, until a maximum salary of 6,300 crowns is reached.

§ 1073.

Chief assistants are to receive 3,480 crowns annually, with an increase of 360 crowns every third year, until a maximum salary of 5,280 crowns is reached.

§ 1074.

1. Permanently appointed scientific assistants, with full time and an executive position in the department in question, are to receive 2,880 crowns

annually with an increase of 360 crowns every third year until the maximum of 5,040 crowns is reached.

2. Other permanently appointed assistants working full time in the Experimental Department are to receive 1,800 crowns annually with an increase of 300 crowns every third year until a maximum salary of 3,000 crowns is reached.

3. When one of the positions referred to in Section 1, § 1074, becomes vacant, an applicant is taken on probation for two years with a salary of 2,880 crowns annually. Should said applicant be permanently appointed, the two years probation are included in his seniority for pay and pension rights. Moreover a position of similar nature and scope in another division of the Experimental Department may be substituted for the period of probation and two years' seniority will be accepted.

§ 1075.

The chief of bureau, whose duties are also secretarial, receives 6,900 crowns annually.

§ 1076.

The head clerk receives 4,800 crowns annually the first five years, then 5,160 crowns annually.

§ 1077.

Scientific assistants permanently employed in the administration department receive 2,880 crowns annually with an increase of 360 crowns every third year until the maximum salary of 5,040 crowns is reached.

§ 1078.

Under-clerks receive 1,320 crowns annually with an increase of 120 crowns every second year until a maximum salary of 2,040 crowns is reached.

Candidates for the above position must be 20 years old and serve on probation with full time for at least one year.

§ 1079.

Experiment leaders, directors of the experiment stations and laboratories, managers of the sub-departments, the chief of bureau and the head clerk are appointed by the King, chief assistants by the Minister of Agriculture, the other functionaries by the director or manager of the department in question.

§ 1080.

When the law went into effect the number of officials employed in the State Experimental Department for Plant Culture ranged as follows:

12 experiment leaders, 1 laboratory director, 8 managers of sub-departments, 2 chief assistants and 26 permanently appointed scientific assistants, 2 of which are in the administrative department.

§ 1081.

If an official is transferred to a position where the initial salary is lower than the terminal salary of his former position, he is at once placed in that wage-scale of the new position where he receives more pay than he had received hitherto; moreover, if, in the old position in the future, by

extra pay for length of service, he would have received a wage which was more than or equal to his wage in the new position, then the difference is added as extra pay for length of service already from that period.

#### § 1082.

In computing extra pay for length of service for those employed in one of the positions named in this section, when this law goes into effect, the seniority they have attained at that time in the position in question is taken into consideration.

By a later Bill the number of the officials was revised and § 1080 now reads:

11 experiment leaders, 1 laboratory director, 6 managers of sub-departments, 23 permanently appointed scientific assistants, of which one is employed in the work of administration, and 1 janitor. To these may be added the Experiment Leader for the Faroe Islands who is classified separately, those managers of departments who are not officially appointed but paid a fee, and the permanent assistants, who are not classified, (Cf. Summary, p. 177).

The Instructions for Experiment Leaders discussed in the business Procedure Regulations, which are drawn up with special view to the positions as directors of the experiment stations, have at all times been in accord with the fundamental rules for the administration of the experiment work. However by the revisions made in the course of years some of the details are altered. There are certain general regulations for all the experiment leaders and managers in common without regard to the location of the station and the problems to be studied; for stations under the same branch of the activity the special regulations are common. For the directors of the horticultural experiment stations the following general regulations apply:

#### Regulations.

Like the experiment leaders of the State Experiments in Plant Culture the Director of the Horticultural Experiment Station is subject to the Law of September 12, 1919, for State Officials, as regards appointment, dismissal, salary, pension, duties, rights, etc.

In his work as experiment leader and director of the station the following regulations are to be observed:

##### 1.

The director is responsible for the work of the station and for keeping within the budget allowed, under the supervision of the State Board of Plant Culture, which is his immediate superior. The director has his residence with garden at the station. He represents the station in all legal matters and is responsible for its rights and duties in every respect.

##### 2.

The work of the Horticultural Experiment Station in co-operation with the other stations, consists of experiments and investigations as planned when the Horticultural Experiment Station was established, (see the official annual report of the State Experimental Department for Plant Culture for 1913—14

and 1914—1915) and, under conditions as they arise, to do all that is possible for the rational development of horticulture here in Denmark.

The director of the station should constantly keep in mind that it is his duty to give practical horticulturists and gardeners all the information possible.

## 3.

Every fiscal year a general plan for the experiments in plant culture is ratified. The plan contains detailed regulations for carrying out experiments and investigations at the experiment stations and must be carefully followed by the director in question. The project for the plan is drawn up by all the experiment leaders and sent to the State Board of Plant Culture before February 1. It is then discussed by the experiment leaders and the Board, eventual modifications made, and the plan ratified by the Board, after which the full responsibility for the work devolves upon the respective experiment leaders under the supervision of the Board.

Records of the results of all the experiments are kept by State Board of Plant Culture in consultation with the experiment leaders. Special forms are used for each experiment series. All the note-books and experiment registries in which the average results are likewise written are kept at the station, carefully marked with the date and experiment series to which they belong. Each year, not later than October 1, the directors send the Board a copy of the records of each experiment series made the preceding fiscal year, accompanied by a sketch of the location of the experiment plots in the field, as well as a commentary on the practical work done in carrying out the experiments with notes on the crop development on the separate plots. If experiment series have been planned, but have as yet given no statistics, the reason for this is stated. Duplicates and notes are kept in the records of the Board to be used in working up the results. A duplicate must only contain material from a single experiment or series of experiments whose results are to be compiled together.

Each year, not later than March 1, the director of each station sends the State Board of Plant Culture a brief summary of the work of the station during the past year which, besides the results of the meteorological observations made daily, contains notes on other conditions which may be of interest in a later compilation of the various experimental results, especially plant development, attacks of disease and insects, etc. The Board publishes these reports and sends a copy to each experiment leader.

## 4.

In consultation with all the experiment leaders the State Board of Plant Culture appoints a speaker for each experiment series. It is the duty of this speaker to compile the results of the experiments in question and write a report. The speaker, in collaboration with the director of the stations where the experiment series has been made, is responsible for the correctness of the material and its compilation. The speaker has access to all the notes, reports and results from the experiment series in question on record in the Board of Plant Culture.

The speaker sends the State Board of Plant Culture the report of the experiments for publication in that form in which it has been endorsed by

the experiment leaders. The Board publishes the report, — noting the fact that said report has been endorsed by the experiment leader in question, — usually in the *Tidsskrift for Planteavl*, and reprints are available through the book-sellers.

For the information of the farmers, the State Board of Plant Culture publishes brief summaries of the work of the State Experiments in Plant Culture through the daily press and agricultural journals. These summaries are compiled by the experiment leaders in common and sent by the speaker of each experiment series to the Board at least one month before publication.

No experiment leader may, on his own account, in print or lecture, make public the results of the State Experimental Department for Plant Culture.

## 5.

Those areas of the experiment stations which, by their nature, location or shape, are unsuited to experiments, are used for plant nurseries, observation or demonstration fields or ordinary agriculture.

The crops are used, or disposed of, as the director judges to be in the best interests of the station.

It is the duty of the director to keep buildings, enclosures, roads, water-courses, etc. belonging to the station in the best possible repair.

If radical improvements or changes are desired at the station, the director must discuss the matter with the State Board of Plant Culture, by whose instructions he must abide in all his work.

## 6.

Each year, before June 1, it is the duty of the leader, after discussion with the other experiment leaders, to present a plan to the State Board of Plant Culture for the budget of his experiment station for the ensuing year. The Board then decides whether, and to what extent, the projects should be recommended to the Ministry of Agriculture in the annual budget for the State Experimental Department for Plant Culture for that year.

State funds granted to the station for a fiscal year are made out in advance in the course of the year to the director, on written application to the Board of Plant Culture.

Each year before May 1, it is the duty of the director to send the State Board of Plant Culture for the Ministry of Agriculture, a complete financial account. This includes vouchers for expenditures of the State grant, the income and expenditure of the station during the past fiscal year, and a list of the machines, tools, apparatus and other goods of the stations. The account is drawn up according to the items on the budget, so that it is apparent how the sum allowed for each is used. The account must contain, or refer to detailed information about all the sources of income, giving the quantity and price of all articles sold, as well as all the expenditures which must be vouched for by receipts for the payment of each sum. The inventory must contain a statement of the articles on hand at the beginning of the year, the decrease and increase in the course of the year, and the amount on hand at the close of the year. Both increase and decrease must be vouched for, — the decrease by an explanatory note, the increase by reference to a number in the list of vouchers.

## 7.

Within the regulations of the Law of September 12, 1919, for State Officials, the director is empowered to appoint and dismiss the assistants and workmen at the experiment station and determine their pay in strict accordance with the items in question on the budget of the station in force at all time.

As compensation for board and lodging (exclusive laundry) which the director provides for the assistants and permanently appointed workmen at the station, a certain sum may be set aside from the running expenses of the station, according to agreement between the State Board of Plant Culture and the experiment leaders.

The director of the station pays the station the market price for the products of the station used in his household. The products from the garden of the official residence, whose service area may not exceed 20 a, and which, — except for the supply of vegetable and flower seed, — is cared for at the cost of the station, may be used by the director.

Other payments, for fuel, gas and electricity, used in house-keeping or privately, are made by the director according to the market price.

For the use of the official residence, see the regulations in the Law referred to above, §§ 36—38.

## 8.

The director is forbidden, under whatsoever form, to dispose of, or allow the disposal of, for cultivation, any of the new forms found by the State Experimental Department before permission to do so has been given by the State Board of Plant Culture after conference with all the experiment leaders.

The director is moreover forbidden, unless permission is granted by the State Board of Plant Culture, to give expert evidence in law-suits.

The experiment station is open to all visitors interested in horticulture.

Without permission from the State Board of Plant Culture, no chemical analyses for private individuals or any institution, except the State Experimental Department, may be made at the Station.

In so far as ways and means permit, the station should supply plant culture exhibitions with material from the experiments, whenever such is desired.

The sum allowed the director for travelling expenses may be used for business trips; actual cost of transportation is listed (II class train, I class steamer) and the additional expenses are computed at 12 crowns per day. In computing the daily expenses an absence from home of more than 6 and until 24 hours is considered 1 day, 6 hours or under,  $\frac{1}{2}$  day.)

If the director makes a journey at the request of societies, associations, or private individuals, his expenses are to be paid by said society, association, or private individual.

## 9.

Lectures or articles held or written by the director for agricultural societies or similar institutions are compensated by mutual agreement. Other-

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<sup>1)</sup> These regulations have been changed under the new general ministerial decree.

wise the director may not receive any pay or compensation for assistance given, or derive any personal economic interest from the purchase or sale of products, tools, machinery, etc. for use at the experiment station.

It appears then, that the regulations in the Business Procedure, State Officials Bill and the Instructions, form the basis for the organisation of the State Experimental Department, its leadership and administration. In its administrative capacity as connecting link between the specially trained leaders of the work and the authorities granting funds, the State Board of Plant Culture acts as a guarantor for the former to the latter. Through the appointment of and instructions to the officials, in its decisions on the proposals to the Ministry for the annual grants to the separate stations and departments, and through its acceptance of the annual working plan for the experiments, the Board reserves the right of regulating the economic conditions, the direction and scope of the experiment work, while the experiment leaders are in every way responsible for the technical direction of the stations and departments, for carrying out the experiments, compiling and publishing the results, and for using the funds granted, within the lines laid down. This division of the authority and responsibility of the organisation has stood the test of years.

Once a year, in the month of June, the experiment leaders and department managers meet to discuss the budget for the following fiscal year. When the proposal made by each separate station and department has been critically discussed with assistance from the Bureau of Plant Culture, they are all sent to the Board of Plant Culture for ratification. They are then discussed at a Board meeting and after the annual tour of inspection to the stations (alternately to Jutland one year and the islands the next) they are turned over to the Bureau, where the final revised proposals for the Budget, as it is to appear before the Parliament, are drawn up. The Bill is usually passed without change. The Board has generally speaking always been happy in the confidence and favour it has enjoyed from the Ministry and Parliament. There are two reasons for this, — the splendid work done by the State Experimental Department, and the sharp criticism to which the proposals made by the experiment leaders are submitted by the Board, each time reducing what in itself is desirable, to what, in the opinion of the Board, is attainable and absolutely necessary. Requests for sums on the annual Budget are always well-weighed and considered, and therefore granted. No doubt but that the Board and the Experimental Department have by this method strengthened their position in the eyes of the authorities granting funds, — without weakening it in the eyes of the farmers.

At the December meetings the discussions of the working-plan for the ensuing fiscal year begin. The experiment leaders first

meet and then present the main points of their plan in a meeting of the chairmen and advisers of the plant culture committees of the Associated Agricultural Societies of the Provinces, representatives for other societies and institutions interested in plant culture, where the objects and the means of the local experiment work is discussed, and where co-operation and division of the work with the State Experimental Department is decided upon. On this as a basis, and paying the necessary consideration to finances, the experiment leaders, at a meeting in January with the department managers and assistants and the advisers in plant culture of the provinces, draw up a detailed proposal for the experiments and send it to the Board of Plant Culture which revises it for printing in the working-plan, each experiment with its number. Proof copies are distributed, and at the final meeting called by the State Board of Plant Culture in March, and attended by experiment leaders and department managers, the proposals for the working-plan are discussed in their entirety, the speakers for each experiment series appointed, and the plan ratified for adoption. Other questions of interest in the work of plant culture are discussed at this meeting; sometimes committees are appointed to investigate, consider and report on matters requiring a more detailed treatment.

When the experiment results are ready, the stations send the Bureau of Plant Culture duplicates of the experiment records with notes referring to the numbers in the working plan and the necessary detail about each experiment. Here they are collected, registered and later sent to the speakers to be used in compiling the reports. When these have been ratified by all the experiment leaders they are sent to the Bureau with short summaries of the experiments. The reports are at once published in »Tidsskrift for Planteavl« and reprints placed on sale in the book-sellers, while 20—30,000 copies of the summaries are first printed for distribution through the daily press and technical journals, at meetings, fairs, etc., to agricultural schools to be used in teaching, and then published in the official journal. Up to date, (1923), 172 experiment reports and 106 summaries have been sent out. To these may be added the annual and monthly reports from the Phytopathological Experiment Department on diseases of cultivated agricultural and horticultural plants.

Periodical reports from the single stations and departments of their work during the year are published in »Annual Report of the State Board of Plant Culture« which is compiled by the Bureau and contains moreover summaries of the assets and organisation of the State Experimental Department, its budget, grants and accounts, reports of meetings and announcements of the most important matters of the year.

The publications of the State Experimental Department for Plant Culture are sent to a great many institutions and individuals in Denmark and in foreign countries, the Agricultural Institute in

Rome (Institut National d'Agriculture), agricultural schools and colleges, libraries, editors of newspapers and magazines, wherever the recipient is believed to be interested in the work. Many institutions send their publications in exchange and these are kept in the library of the State Board of Plant Culture.

As the above indicates, the main object of the work of the State Board of Plant Culture is, in behalf of the Ministry of Agriculture, to supervise the State Experimental Department for Plant Culture. However, constituted authorities and institutions, especially the Ministries, have often called upon the Board to act in an advisory capacity in questions pertaining to plant culture in general, even though these had sometimes no connection whatsoever with the experiment work. The Board, too, on its own initiative, has raised similar questions and found ways for their solution. Whether or not the Board may thus be said to have become, — or to have had the intention of becoming, — a general public welfare board in matters pertaining to plant culture, yet in the course of years, — as a rule after preliminary discussions with the experiment leaders, — it has caused measures to be adopted, reported on and proposed a great many things of vital importance for agriculture in Denmark. The majority of special reports (30—40 annually), are required of the Board by the Ministry, and have direct connection with, or influence on, the State Experimental Department. Among the other matters which the State Board of Plant Culture has brought to completion, the most important are:

Gratis distribution of seed and seedling potatoes of good variety and strain from 1900—1909.

Propagation of seed-grain for the instruction fields of the agricultural societies 1903—1909.

Investigations of the grass fields of Jutland, 1905—1910, following a plan similar to the one used in *P. Nielsen's* grass field investigations of the last century. The actual investigations were made by *E. Lindhard*, with the help of funds from the Julius Skrike Legacy, through the Royal Agricultural Society.

Training of Jutland root crop assistants in the sugar beet districts of Funen and Lolland-Falster, 1901—1905, with aid from the Royal Agricultural Society.

Improvement in the harvest statistics, including the use of the dry substance percentage in computing the root harvest, after 1904; the determination of the value of grass and green fodder on the basis of the accounts from the Cow Test Associations, after 1911.

Proposal for improvement in the service of the Meteorological Institute.

Carrying through a common unity determination for 100 kilogram = hektokilogram, hkg, after 1910.

Enforcement of stricter measures for combatting weeds on railroad property, after 1910.

Collaboration with the Royal Agricultural Society in the publication of a text-book to be used in the country district schools, 1909.

Proposal of various prize-questions through the Royal Danish Scientific Society and the Royal Agricultural Society.

The arrangement of large plant culture expositions, among these, one at the World's Fair in Paris, 1900.

The management and distribution of State funds for furthering work in plant culture in the agricultural societies, 1898—1906. Repeal of a plant culture act and the passage of Ministerial regulations<sup>1)</sup>. Since 1914, with the approval of the Board of Plant Culture, the Chief of Bureau, on his own responsibility, with assistance from the Bureau, has taken charge of the Ministry of Agriculture's supervision and control of these State funds.

The establishment, organisation and administration of the State Department for the Improvement of the Soil, 1918, — »for the present until a final arrangement can be made«. On April 1, 1919, the administration of this State institution was transferred to the State Board for Improvement of the Soil, and three years later to the Danish Heath Society.

Plan and preliminary investigations for the utilisation of the Great Wild Moors in northern Jutland, 1918.

Project for loans for the improvement of the soil, 1919.

Reorganisation and restriction of the grants to the Danish Heath Society for moor and meadow cultivation, regulation of canals and water heights, moor investigations and the planting of enclosures and lee-belts, 1918—1919.

Discontinuance of the positions of Advising Specialist in Plant Diseases to the Ministry of Agriculture and State Adviser in Plant Culture for Jutland, 1921.

Investigation of the development and condition of fruit culture in various districts of the country, 1919<sup>2)</sup>.

Through collaboration with various institutions and organisations, the Board has furthermore assisted in carrying out a series of other measures, — investigations on the contents of nutritive substances and fodder value of fodder plants, after 1911, in collaboration with the Laboratory of Agricultural Research, after 1921, through the Associated Committee for the State Experiments in Plant Culture and Animal Husbandry); experiments with Danish seed abroad after 1912; in collaboration with the Royal Agricultural Society experiments and investigations on the planting of enclosures and lee-belts in collaboration with agricultural and small-holders societies, 1913—15<sup>3)</sup>; and finally, local plantations for the observation of fruit varieties,

<sup>1)</sup> Cf. H. C. Larsen: I. c. p. 152.

<sup>2)</sup> Cf. Tidsskrift for Planteavl, Vol. 26, p. 80 and ff.

<sup>3)</sup> Cf. Tidsskrift for Planteavl, Vol. 24, p. 531 and ff.

test cultivation of kitchen-vegetables and experiments in baking, using domestic and imported flour.

After 1916, the management of the State Farm in Jullerup (44 ha) used for seed growing, propagation of seed, test cultivation, etc., was placed under the administration of the State Board of Plant Culture, and after 1917 the Board has appointed two representatives on the Associated Board of Managers of the State Farms at Hillerød (516 ha) which is at the disposal of the State Experiments in Animal Husbandry, the Laboratory of Agricultural Research and the Experimental Dairy (with laboratory).

### Comments on the Experiment Work.

To give a description of the experiment work and its results lies outside the domain of the present paper. The main object of the experiments was from the first, and continues to be, to investigate and answer questions of direct interest to the practical farmer in his work in plant culture. The experiments are stationary field experiments, carried out in as close connection with, and relation to, the natural conditions found in practice as possible. Pot-experiments have proved of negligible importance. Thorough botanical, chemical, bacteriological and phytopathological investigations, as well as investigations of experimental-technical nature, are connected with the field experiments, — with the object of attaining not only the most comprehensive exhaustive answer to the questions, but the most accurate dependable results as well.

The foundation of the experiment methods now in use was established by *P. Nielsen*. He introduced the use of replicate plots, (that is to say, several homogeneously treated experiment plots of the same number), diminished the size of the plots, abolished the inter-jacent unplanted paths, and thereby augmented the number of replicate plots, so that by the distributing these evenly over the experiment field, it became possible, to a far greater extent than hitherto, to control the homogeneity of the soil and the certainty of the work.

In the distribution of the experiments between the various stations, the kind of experiment and the scope of the results are taken into consideration. Experiments dealing with problems presumably of interest to farmers throughout the land, whose solution, however, may be supposed to depend on the conditions of soil and climate in the various parts of the country, are carried out at several, or all of the stations at the same time; whereas experiments and investigations dealing with problems whose solution does not depend in particular on conditions of soil and climate and other local conditions, and whose results may be presumed to be applicable in large sections of the country, as well as experiments and investigations especially applicable to that section or district where the station is located are

only carried out at a single experiment station or experiment locality. As a rule each experiment series extends through several years. The total number of experiments made each year is about 300. Of these, at present 15—20, are variety and strain experiments, 60, experiments in the use of fertilisers, the rotation of crops, and treatment of the soil, 20, experiments in fodder crops and 20 in plant breeding and seed growing, 30, moor experiments, 40, horticultural experiments, 60—70, experiments in combatting weeds and plant diseases, and 10—20, soil-bacteriological-chemical investigation series.

For further detail on the kind and scope of the problems studied by the State Experimental Department for Plant Culture in the course of years and the results obtained, see the list at the end of the chapter, of the reports and announcements published by the Experiment Department (p. 208 and ff.), as well as the summary in *Karsten Iversen's* »Oversigt over de for Landbruget vigtigste Resultater af Statens Forsøg i Plantekultur«, to be found in the *Tidsskrift for Planteavl*, Vol. 28, pp. 416—513, on sale as a reprint at the book-dealers.

In closing, mention must be made of the work in plant breeding which has been accomplished at the experiment stations. This is work of purely personal character, done by the officials solely through interest in the question, and has cost the State practically nothing. Its aim has been through scientific study to investigate the methods and possibilities in plant breeding, with the purely practical object of securing more valuable strains, giving a greater yield. Most important are the results of this work which has contributed greatly to the increased yield from plant culture here in Denmark.

Of new strains of cultivated plants, produced through the State Experimental Department for Plant Culture, and of which the majority after being submitted to comparison tests for several years have been applied in practice and gained widespread recognition, the following deserve mention here:

From the Tystofte Experiment Station.

Breeding begun and carried out by *N. P. Nielsen*, or begun by him and carried out by *E. Lindhard*.

1. *Tystofte Prentice-Byg* (Tystofte Prentice Barley). On the market 1902. New pure culture, 1918.
2. *Tystofte seksradet Byg* (Tystofte six-rowed Barley). On the market 1904.
3. *Gulhvid Tystofte Havre* (Yellow-white Tystofte Oats). On the market 1907.
4. *Tystofte Smaahvede* (Tystofte Small Wheat). On the market 1909.
5. *Tystofte Standhvede* (Tystofte Standing Wheat). On the market 1909.
6. *Tystofte Kors-Byg* (Tystofte Cross Barley). On the market 1911.
7. *Tystofte Stjerne-Havre* (Tystofte Star Oats).
8. *Tystofte Smaahvede II* (Tystofte Small Wheat II). On the market 1913.
9. *Tystofte Standhvede II* (Tystofte Standing Wheat II). On the market 1913.
10. *Italiensk Rajgræs. Tystofte Nr. 152* (Italian Ryegrass. Tystofte Nr. 152). On the market 1913.

11. *Dronning Wilhelmina-Hvede II* (Queen Wilhelmina Wheat II). On the market 1915.
12. *Barres. Tystofte V* (Barres Mangold. Tystofte V). On the market 1917.
13. *Tidlig Rødkløver. Tystofte Nr. 40* (Two Cut Red Clover. Tystofte No. 40). On the market 1919.
14. *Gul Rundbælg. Tystofte Nr. 8* (Yellow Kidney Vetch. Tystofte No. 8).
15. *Almindelig Rajgræs. Tystofte Nr. 10* (Perennial Rye-Grass. Tystofte No. 10).

Breeding begun and carried out by *E. Lindhard*.

16. *Bikløver* (Honey-Clover) (white-flowering red clover with short corolla tube).
  17. *Sukkerroe. Tystofte Nr. 201* (Sugar Beets. Tystofte No. 201).
- From the Lyngby Experiment Station. *K. Hansen*, Leader.
18. *Lyngby Prentice-Byg* (Lyngby Prentice Barley). On the market 1898.
  19. *Lyngby Vintervikke* (Lyngby Winter Vetches). On the market 1908.
  20. *Lyngby Vinterbygg. A. og B.* (Lyngby Winter Barley. A. and B.). On the market 1912.
  21. *Lyngby Hede-Havre* (Lyngby Heath Oats). On the market 1913.

From the Studsgaard Experiment Station. *C. J. Christensen*, Leader.

22. *Kaalroe. Studsgaard Bangholm* (Swedes. Studsgaard Bangholm). On the market 1917.

Mention should also be made of the strains cultivated by *H. A. B. Vestergaard*, which, with the exception of the first, are all bred at Abed Experiment Station for Plant Culture, namely:

1. *Gul Næsgaard Havre* (Yellow Næsgaard Oats).
2. *Abed Storaks-Hvede* (Abed Large Spike Wheat).
3. *Toradet Byg. Abed Nr. 278* (Two-rowed Barley Abed No. 278).
4. *Abed Prentice-Byg* (Abed Prentice Barley).
5. *Abed Binder-Byg* (Abed Binder Barley).
6. *Abed Rex-Byg* (Abed Rex Barley).
7. *Abed Juli-Byg* (Abed July Barley).
8. *Abed Nova-Havre* (Abed Nova Oats).

### The Experiment Stations and Divisions of the State Experimental Department for Plant Culture, 1923.

(See the map of the soils of Denmark, p. 126).

#### Agricultural Experiments.

The Tystofte Experiment Station at Tystofte, by Tjæreby in south western Seeland. Established 1886. State-property 1899. 30 ha loamy soil with sandy loam sub-soil.

Experiment Leader, *Josef Hansen*, Agricultural Graduate.

Experiment Area at Abed by Søllested, Lolland. Established 1903. Leasehold property. 1.7 ha good loamy soil with loamy sub-soil.

Manager, *H. A. B. Vestergaard*, Agricultural Graduate.

The Lyngby Experiment Station at Lyngby, north eastern Seeland. Established 1890. State control 1893. State property 1914. 46 ha light loamy soil, sub-soil, stony mixed with sand.

Experiment Leader, *J. C. Larsen*, Agricultural Graduate.

Experiment Area at Aakirkeby on Bornholm. Established 1905. Leasehold property. 3 ha heavy loamy soil with clayey sub-soil.

Manager, *Aage Brandt*, Agricultural Graduate.

The Aarslev Experiment Station at Aarslev on Funen. Established 1905. State property. 33 ha good loamy soil with clayey sub-soil mixed with sand.

Experiment Leader, *N. A. Hansen*, Agricultural Graduate.

The Askov Experiment Station at Askov, by Vejen in southern central Jutland. Established 1885. State property after 1925. 23 ha light loamy soil with clayey subsoil mixed with sand, 52.5 ha very light, dry, sandy soil (Lundgaard) and 5.5 ha high peat bog soil.

Experiment Leader, *Karsten Iversen*, Agricultural Graduate.

The Studsgaard Experiment Station at Studsgaard in central Jutland. Established 1906. Leasehold. 45 ha poor, sandy soil with stony, sandy sub-soil; 15 ha good sandy loamy soil with sandy sub-soil near Borris in west Jutland; 23 ha high peat bog soil and 14 ha low peat bog soil near Herning in central Jutland.

Experiment Leader, *N. J. Nielsen*, Agricultural Graduate.

The Tylstrup Experiment Station at Tylstrup in Vendsyssel. Established near Vester Hassing 1894; removed to Tylstrup 1906; State property 1925. 37 ha fine sandy loamy soil with sandy sub-soil.

Experiment Leader, *L. P. Jacobsen*, Agricultural Graduate.

Moor experiments near Tylstrup (Fossevangen) on the Great Wild Moor. Established 1906. State property 1918. 52 ha high peat bog soil; 37 ha low peat bog soil.

Manager, *N. Abildgaard*, Agricultural Graduate.

The Højvig Experiment Station at Højvig near Thorshavn on the Faroe Islands, (Sydstrømø). Established 1920. State property. 9 ha home-field with soil rich in humus, clay sub-soil; 10 km<sup>2</sup> distant-field with pasturage for 450 sheep; 7 ha good soil rich in humus with sub-soil mixed with gravel in Trødum on Sandø; and a distant-field of 5 km<sup>2</sup> for sheep-breeding experiments in Kvalvig on Nordstrømø with pasturage for 170 sheep.

Experiment Leader, *Ejnar Knudsen*, Agricultural Graduate.

The State Marsh Experiments. Established 1923. 3 experiment areas and ambulatory experiments in south western Jutland.

Experiment Leader, *C. J. Christensen*, Agricultural Graduate.

The State Experiments with Weeds. Begun at Lyngby, 1918.

Acting Experiment Leader, State Adviser *K. Hansen*.

The State Experiments with Roots. Begun 1886. Under State control 1893.

Acting Experiment Leader, Professor *E. Lindhard*.

Experiments and Investigations with Fodder Crops. Begun 1911.

The Laboratory: Dronningens Vænge, Lyngby.

Department Manager, *R. K. Kristensen*, Agricultural Graduate.

### Horticultural Experiments.

The Blangsted Experiment Station at Blangsted, by Odense on Funen. Established 1915. State property 1955, at the latest. 60 ha good loamy soil with clayey sub-soil.

Experiment Leader, *Niels Esbjerg*, Agricultural Graduate.

The Spangsbjerg Experiment Station at Spangsbjerg, by Esbjerg in western Jutland. Established 1908; under State control 1915; State property 1945 at the latest. 26 ha good sandy loam with sandy sub-soil mixed with clay. Experiment Leader, *Edv. Christiansen*, Horticultural Graduate.

The Hornum Experiment Station at Hornum in Himmerland. Established in 1916. Leasehold. 33 ha sandy loam with sandy sub-soil.

Experiment Leader, *Hakon Sørensen*, Horticultural Graduate.

**The State Phytopathological Experiment Department.** Established 1905; under State control 1913; Reorganised and extended 1922; State property. 4.5 ha light, loamy soil at Lyngby; 1.6 ha at Tystofte. Laboratory and Office, Dronningens Vænge, Lyngby.

Acting Experiment Leader, Professor, Dr. *C. Ferdinandsen*, Department Managers, *Ernst Gram*, M. Sc. and *Sofie Rostrup*, M. Sc.

**The State Laboratory for Plant Culture.** Established 1909; Reorganised and enlarged 1923. State property. 1 ha light, loamy soil. Laboratory and Office, Frederiksdalsvej, Lyngby.

Director of the Laboratory, *Harald R. Christensen*. Department Manager, *E. J. Petersen*, M. Sc.

### The State Board of Plant Culture.

#### Members.

Representatives for the Royal Danish Agricultural Society.

*K. Sehested*, from the spring of 1898 until his death, August 28, 1909.

*Carl Bech*, during 1910.

*T. Westermann*, 1911—18, inclusive.

*V. Selchau-Hansen*, from the beginning of 1919.

Representatives for the Royal Veterinary and Agricultural College.

*T. Westermann*, from the spring of 1898, until the end of 1910.

*V. Storch*, from the spring of 1911 until his death August 1, 1918.

*F. Kølpin Ravn*, from the autumn of 1918 until his death May 25, 1920.

*Fr. Weis*, from the autumn of 1920.

Representatives for the Associated Danish Agricultural Societies.

*M. Ahlmann*, from the spring of 1898 until his death July 12, 1902.

*And. Nielsen*, from August 1, 1902, until the end of 1914.

*Vilh. Pinholt*, from the beginning of 1915.

Representative for the Associated Danish Small-holders Societies.

*Emil Rasmussen*, from the beginning of 1917.

Representatives for the Horticultural Organisations.

*Alfr. Bruun*, from the beginning of 1917 until his death March 20, 1923

*Svend Bruun*, from June 21, 1923.

## Composition.

- I. From the spring of 1898 until July 12, 1902:  
*K. Sehested* (Chairman), *T. Westermann*, *M. Ahlmann*.
- II. From August 1, 1902 until August 28, 1909:  
*K. Sehested* (Chairman), *T. Westermann*, *And. Nielsen*.
- III. During the year 1910:  
*Carl Bech* (Chairman), *T. Westermann*, *And. Nielsen*.
- IV. From the spring of 1911 until the close of 1914:  
*T. Westermann* (Chairman), *V. Storch*, *And. Nielsen*.
- V. During the years 1915 and 1916:  
*T. Westermann* (Chairman), *V. Storch*, *Vilh. Pinholt*.
- VI. From the beginning of 1917 until August 1, 1918:  
*T. Westermann* (Chairman), *V. Storch*, *Vilh. Pinholt*, *Emil Rasmussen*, *Alfr. Bruun*.
- VII. In the autumn of 1918:  
*T. Westermann* (Chairman), *F. Kølpin Ravn*, *Vilh. Pinholt*, *Emil Rasmussen*, *Alfr. Bruun*.
- VIII. From the beginning of 1919 until May 25, 1920:  
*Vilh. Pinholt* (Chairman), *F. Kølpin Ravn*, *V. Selchau-Hansen*, *Emil Rasmussen*, *Alfr. Bruun*.
- IX. From the autumn of 1920 until March 20, 1923:  
*Vilh. Pinholt* (Chairman), *Fr. Weis*, *V. Selchau-Hansen*, *Emil Rasmussen*, *Alfr. Bruun*.
- X. From June 21, 1923:  
*Vilh. Pinholt* (Chairman), *Fr. Weis*, *V. Selchau-Hansen*, *Emil Rasmussen*, *Svend Bruun*.

## Officials

in the State Department of Plant Culture from its Foundation until 1924.

- Abildgaard*, N., Agr. Grad., b.  $\frac{1}{15}$  1881. Assistant in the Moor-Experiments at Tylstrup 1906—22. From 1922 Department Manager Tylstrup.
- Andersen*, A., b.  $\frac{11}{4}$  1856. Assistant at Askov Experiment Station from 1894.
- Andresen*, P., b.  $\frac{9}{28}$  1860. *P. Nielsen's* assistant at Ørslev 1881. From 1908 Director of the Folk High School at Vinding by Vejle.
- Bacher*, T., Hort. Grad., b.  $\frac{4}{21}$  1895. Assistant at Blangsted from 1919.
- Bagge*, H., Agr. Grad., b.  $\frac{1}{11}$  1895. Assistant at Tystofte from 1918.
- Bjerre*, M., Agr. Grad., b.  $\frac{8}{28}$  1884. Assistant at Studsgaard 1906—08 and 1910—13. From 1923 manager of the Anton Nielsen Seed Co., Inc., Kolding.
- Bondorff*, K., Agr. Grad., cand. phil., b.  $\frac{9}{18}$  1891. Department Manager of the State Laboratory for Plant Culture 1921—23. After 1923 Professor at the Royal Agricultural College.
- Borke*, S. *Boberg*, Agr. Grad., b.  $\frac{4}{27}$  1879. Assistant at the Lyngby Experiment Station 1905—06. From 1917 gentleman farmer, Hegnet by Hedehusene.
- Brandt*, Aage, Agr. Grad., b.  $\frac{7}{21}$  1893. Manager at Aakirkeby from 1920.
- Christensen*, C. J., Agr. Grad., b.  $\frac{7}{8}$  1883. Assistant at Studsgaard Experiment Station 1908—09. Assistant at the Moor Experiments Herning 1909—16. Department Manager same place 1916—23. Leader of the State Marsh Experiments 1923.
- Christensen*, Harald R., Agr. Grad., b.  $\frac{5}{7}$  1879. Assistant at Askov Experiment Station and others, 1903—05. Worked independently 1905—09. Manager of the State Laboratory for Plant Culture 1909—19. Director of the State Laboratory for Plant Culture 1919.
- Christensen*, Jørgen, Agr. Grad., b.  $\frac{9}{27}$  1893. Assistant at the Studsgaard Experiment Station 1917—18. From 1919 Leader of seed-grain propagation for the Association of Jutland Agricultural Societies.

- Christiansen, C. J. J.*, b.  $\frac{5}{21}$  1878. Functionary in the employ of the State Phytopathological Experiment Department, 1923.
- Christiansen, Edv.*, Hort. Grad., b.  $\frac{5}{27}$  1885. Assistant at the Spangsbjerg Experiment Station 1913—15. Manager of the Sub-station 1915—19. Experiment Leader and Director of the Spangsbjerg Experiment Station from 1919.
- Christiansen, H. T.*, Agr. and Hort. Grad., b.  $\frac{8}{17}$  1867. Assistant at the Lyngby Experiment Station 1900—01. From 1917 Director of the Danish Propagating Society, Hou.
- Dalsgaard, J.*, b.  $\frac{9}{26}$  1895. Assistant at Højvig from 1923.
- Davidson, David P.*, b.  $\frac{7}{30}$  1877. Assistant at Askov Experiment Station 1904—14. From 1917 check-clerk of the South Jutland Cereal and Fodder Co.
- Dorph-Petersen, K.*, Agr. Grad., Cand. phil., b.  $\frac{5}{8}$  1872. Secretary of the State Board of Plant Culture 1898—1903. From 1903 Director of the State Seed Testing Station.
- Eibye, Paula*, b.  $\frac{10}{29}$  1888. From 1916, assistant at the State Laboratory for Plant Culture.
- Elberg, Ove*, Hort. Grad., b.  $\frac{9}{25}$  1862. Manager of the Aakirkeby Experiment Station 1905—13. From 1913 Manager of the Agricultural Societies' Seed Trade, Roskilde.
- Ellehauge, J. C.*, Agr. Grad., b.  $\frac{8}{10}$  1885. Assistant at Studsgaard 1916—17. From 1917 Advising Specialist to Kalø-Vig Agricultural Society.
- Esbjerg, Niels*, Agr. Grad., b.  $\frac{2}{21}$  1881. Experiment Leader at Spangsbjerg 1909—15, at Blangsted after 1915.
- Feilberg, Niels*, Cand. polyt., b.  $\frac{9}{22}$  1885. Assistant at the State Laboratory for Plant Culture, 1912—21. From 1921 assistant at the Royal Agricultural College.
- Ferdinandson, C.*, Dr. phil., b.  $\frac{2}{18}$  1879. Botanist to the State Phytopathological Experiment Department 1917—19. Experiment Leader same from 1919. From 1920 Professor at the Royal Agricultural College.
- Fonager, C. C.*, b.  $\frac{4}{16}$  1894. Assistant at the Moor Experiments Tylstrup 1923.
- Frandsen, H. N.*, Agr. Grad., b.  $\frac{9}{27}$  1881. Assistant at Tystofte Experiment Station 1910—12. From 1916 Leader of the Experiment Farm, Øtoftegaard by Taastrup.
- Gram, Ernst*, Cand. mag., b.  $\frac{5}{21}$  1891. Assistant in the State Phytopathological Experiment Department 1917—19. Department Manager same, from 1919.
- Hansen, A. J.*, Agr. Grad., b.  $\frac{2}{28}$  1857. Assistant at Askov Experiment Station 1886—94. Experiment Leader at Vester Hassing and Tylstrup until his death  $\frac{7}{17}$  1911.
- Hansen, Fr.*, Agr. Grad., b.  $\frac{5}{23}$  1854. Manager sub-station, Askov Experiment Station 1885—93. Experiment Leader Askov Experiment Station 1893—1921. State Adviser in Plant Culture, mainly for Jutland, from 1893 until his death,  $\frac{5}{29}$  1921.
- Hansen, Frode*, Agr. Grad., b.  $\frac{11}{18}$  1888. Assistant at the Askov Experiment Station from 1914.
- Hansen, H. H. Holme*, Agr. Grad., b.  $\frac{7}{11}$  1889. Assistant at the Lyngby Experiment Station 1913—14. From 1918 Advising Specialist to the Associated Lolland Falster Agricultural Societies.
- Hansen, Josef*, Agr. Grad. b.  $\frac{8}{11}$  1888. Assistant at the Askov Experiment Station, 1916—21, Department Manager same 1921—23. Experiment Leader at the Tystofte Experiment Station from 1923.
- Hansen, K.*, Agr. Grad., b.  $\frac{11}{2}$  1858. Experiment Leader at the Lyngby Experiment Station 1890—1914. Leader of the State Experiments with Weeds, 1918. State Adviser in Plant Culture, mainly for the Islands, from 1893.

- Hansen, K. Sidenius*, Agr. Grad., b.  $\frac{3}{8}$  1868. Assistant at Tystofte Experiment Station 1889—90 and 1893—95. From 1920 instructor at Skaarup Agricultural High School.
- Hansen, N. A.*, Agr. Grad., b.  $\frac{9}{24}$  1857. Assistant at Tystofte Experiment Station 1886—88. Experiment Leader at Aarslev Experiment Station from 1905.
- Hansen, P.*, Hort. Grad., b.  $\frac{2}{13}$  1864. Assistant at Tystofte Experiment Station 1898—1917. Department Manager of the State Farm in Jullerup from 1917.
- Helweg, L.*, Hort. Grad., b.  $\frac{3}{2}$  1851. Experiment Leader to the Society for the Improvement of Cultivated Plants 1886—93, of the State Ambulatory Experiments with Root-Crops from 1893 until his death  $\frac{8}{6}$  1920.
- Henriksen, Aksel*, b.  $\frac{3}{17}$  1891. Assistant at the Spangsbjerg Experiment Station from 1914.
- Iversen, Karsten*, Agr. Grad., b.  $\frac{6}{1}$  1886. Assistant at Tystofte Experiment Station 1912—21. Experiment Leader, Askov Experiment Station, from 1921.
- Jacobsen, L. P.*, Agr. Grad., b.  $\frac{5}{30}$  1871. Experiment Leader, Tylstrup Experiment Station, from 1912.
- Jensen, J.*, Agr. Grad., b.  $\frac{7}{20}$  1876. Assistant at the Lyngby Experiment Station from 1904.
- Jensen, Johannes*, Agr. Grad., b.  $\frac{10}{12}$  1880. Manager of Aakirkeby 1913—16. From 1922 Director of Kærehave Agricultural School by Ringsted.
- Jensen, J. Løvendahl*, Agr. Grad., b.  $\frac{4}{14}$  1882. Assistant at Aarslev Experiment Station from 1908.
- Jensen, J. M.*, b.  $\frac{10}{27}$  1869. Assistant at Tystofte Experiment Station 1896—98. From 1899 manager of his own farm, Snebjerg by Herning.
- Jensen, N. K.*, b.  $\frac{9}{6}$  1872. Assistant at Studsgaard Experiment Station from 1907.
- Johannesen, J. David*, Agr. Grad., b.  $\frac{11}{30}$  1884. Assistant at Lyngby Experiment Station 1909—12. At present abroad.
- Johnsen, J.*, Agr. Grad., b.  $\frac{4}{17}$  1882. Assistant at Lyngby Experiment Station 1908—19. From 1919 Experiment Leader for the Dæhnfeldt Seed Co., Inc., Odense.
- Jørgensen, Jørgen*, b.  $\frac{9}{28}$  1869. Assistant at Vester Hassing Experiment Station 1894—97. Assistant at Askov Experiment Station from 1897.
- Jørgensen, M.*, b.  $\frac{4}{12}$  1886. Assistant at Tystofte Experiment Station 1911—23. Assistant to the State Experiments with Roots, from 1923.
- Kirkegaard, Andreas*, b.  $\frac{9}{20}$  1893. Assistant to the Moor Experiments at Herning from 1921.
- Kirkegaard, M. V. J.*, Agr. Grad., b.  $\frac{9}{17}$  1884. Assistant at Tylstrup Experiment Station 1910—14. From 1915 Secretary and Treasurer of the Agricultural Society of the Aalborg District.
- Klitgaard, N.*, b.  $\frac{9}{16}$  1883. Assistant at Studsgaard Experiment Station (Borris) from 1907.
- Knudsen, Ejnar*, Agr. Grad., b.  $\frac{11}{5}$  1888. Assistant at Tystofte Experiment Station 1909—10, at Lyngby Experiment Station 1912. Manager at Aakirkeby 1917—20. Experiment Leader at Højvig in the Faroe Islands, from 1920.
- Kristensen, Kr.*, Agr. Grad., b.  $\frac{11}{18}$  1892. Assistant at Tylstrup Experiment Station 1913—15. From 1919 Advising Specialist in Plant Culture to the Associated Agricultural Societies of the Province of Funen.
- Kristensen, R. K.*, Agr. Grad., b.  $\frac{10}{21}$  1875. Assistant at Askov Experiment Station 1904—13. Department Manager of Experiments and Investigations with Fodder Crops etc., from 1913.
- Kristoffersen, K. V.*, Agr. Grad., b.  $\frac{7}{20}$  1880. Assistant at the Lyngby Experiment Station 1907—08. From 1908 Advising Specialist in Plant Culture to the Agricultural Societies of the Vejle Province.

- Larsen, Bastian R.*, Norwegian Agr. Grad., b. 1856. Assistant to *P. Nielsen* in Ørslev, 1880. Experiment Leader, Head Master, Professor and, 1913—18, Director of the Agricultural College, Norway. Died  $\frac{7}{4}$  1919.
- Larsen, H. C.*, Agr. Grad., b.  $\frac{8}{8}$  1870. Treasurer of the Royal Agricultural Society 1895—1915. Treasurer and assistant to the State Board of Plant Culture 1898—1903. Secretary of the State Board of Plant Culture 1903—16. Chief of Bureau from 1916. Editor of the official journal of the Board, »Tidsskrift for Planteavl« from 1907.
- Larsen, J. C.*, Agr. Grad., b.  $\frac{2}{2}$  1872. Assistant at the Lyngby Experiment Station 1901—14. Experiment Leader same, from 1914.
- Larsen, Knud*, b.  $\frac{12}{2}$  1876. Assistant at Vester Hassing Experiment Station 1900—05. From 1905 Experiment Leader to the Trifolium Co. Inc. Died  $\frac{11}{25}$  1920.
- Larsen, L. P. M.*, Agr. Grad., b.  $\frac{1}{28}$  1877. Assistant to the State Board of Plant Culture 1909—16. Head clerk same from 1916.
- Larsen, Thorkil*, Agr. Grad., b.  $\frac{11}{6}$  1879. Assistant to the State Board of Plant Culture from 1918.
- Lauridsen, C. P.*, Agr. Grad., b.  $\frac{2}{17}$  1877. Assistant at Vester Hassing and Tylstrup Experiment Station 1904—07. From 1916 independent farmer, Vejlbj by Riisskov.
- Lauridsen, L.*, b.  $\frac{4}{1}$  1879. Assistant at Tylstrup Experiment Station from 1905.
- Lind, J.*, Cand. pharm., b.  $\frac{8}{1}$  1874. Botanist to the State Phytopathological Experiment Department 1913—17. From 1917 apothecary in Østbirk.
- Lindhard, E.*, Agr. Grad., b.  $\frac{8}{12}$  1873. Assistant to the State Board of Plant Culture 1904—09. Experiment Leader at the Tystofte Experiment Station 1909—23. From 1923 Professor at the Royal Agricultural College.
- Lunde, S. N.*, Agr. Grad., b.  $\frac{5}{6}$  1861. Assistant at the Lyngby Experiment Station 1893—99. From 1921 manager of the Spangsbjerg Mill, Esbjerg.
- Lunden, J. Chr.*, Agr. Grad., b.  $\frac{11}{9}$  1890. Assistant to the State Experiments with Roots from 1917.
- Madsen, Maria*, Cand. pharm., Assistant to the State Laboratory for Plant Culture 1921. From 1921 part proprietor of the Soil Laboratory, Copenhagen.
- Madsen-Mygdal, Aage*, Agr. Grad., b.  $\frac{4}{4}$  1872. Assistant at the Tystofte Experiment Station 1895—97, at Vester Hassing 1898—99. Advising Specialist in Plant Culture for the Associated Agricultural Societies of the Funen District 1900—12. Died  $\frac{10}{9}$  1922.
- Marcussen, M.*, b.  $\frac{8}{25}$  1879. Assistant at the Lyngby Experiment Station from 1914.
- Mariboe, Carl*, Hort. Grad., b.  $\frac{3}{10}$  1859. Assistant to the State Board of Plant Culture 1915—23.
- Mattesen I. Th.*, b.  $\frac{2}{18}$  1870. Assistant at the Tylstrup Experiment Station from 1916.
- Mikkelsen, M. J.*, Agr. Grad., b.  $\frac{11}{5}$  1873. Assistant at the Askov Experiment Station 1906—09. From 1911 estate-agent in Vejle.
- Mortensen, M. L.*, Agr. Grad., Mag. Sc., b.  $\frac{2}{25}$  1881. Assistant at the Lyngby Experiment Station 1906—07. From 1907 Advising Specialist in Plant Disease to the Associated Danish Agricultural Societies. Died  $\frac{12}{8}$  1911.
- Mouritsen, M. Chr.*, b.  $\frac{8}{12}$  1894. Assistant to the Moor Experiments at Tylstrup 1918—23. From 1923 State Small-holder, Sønder Elkær by Sulsted.
- Møller, Erik*, Agr. Grad., b.  $\frac{3}{4}$  1880. Assistant at the Aarslev Experiment Station 1907—08. From 1917 independent farmer, Rørkærsgaard by Dyssekilde.
- Møller, Mathilde Margrethe*, b.  $\frac{4}{30}$  1877. Clerk for the State Experiments with Roots 1914—23.
- Nestén, J.*, Agr. Grad., b.  $\frac{2}{18}$  1894. Assistant at the Studsgaard Experiment Station from 1918.

- Nielsen, Agnes*, b.  $^{12}/_{10}$  1884. Assistant to the State Board of Plant Culture from 1906.
- Nielsen, Laurids*, Agr. Grad., b.  $^8/_16$  1879. Assistant at the Lyngby Experiment Station 1904—06. From 1913 independent farmer, Vejbjerggaard by Sorø.
- Nielsen, N. J.*, Agr. Grad., b.  $^{11}/_{21}$  1862. Assistant at the Tystofte Experiment Station 1891—93, at Askov 1894—1906. Experiment Leader at the Studsgaard Experiment Station from 1906.
- Nielsen, N. K.*, Agr. Grad., b.  $^4/_9$  1872. Assistant at the Vester Hassing Experiment Station 1897—98. From 1911 independent farmer, Follerupgaard by Fredericia.
- Nielsen, N. P.*, Agr. Grad., b.  $^6/_11$  1865. Experiment Leader at the Tystofte Experiment Station from 1897 until his death  $^{11}/_{15}$  1908.
- Nielsen, P.*, village school-master, b.  $^7/_28$  1829. Adviser and Experiment Leader in Plant Culture to the Royal Agricultural Society 1882—86. Founder and Leader of the Experiment Department, State Adviser and Experiment Leader at the Tystofte Experiment Station from 1886 until his death,  $^9/_80$  1897.
- Nissen, L.*, b.  $^6/_3$  1878. Assistant at the Aarslev Experiment Station from 1907.
- Olesen, V.*, b.  $^1/_5$  1888. Functionary in the employ of the State Laboratory for Plant Culture from 1923.
- Olsen, H. J.*, b.  $^4/_17$  1890. Assistant at the Hornum Experiment Station from 1918.
- Olsen, H. P.*, Agr. Grad., b.  $^2/_2$  1871. Assistant at the Vester Hassing Experiment Station 1898—1900. From 1912 editor of Næstved Tidende, Næstved.
- Overgaard, N.*, Agr. Grad., b.  $^8/_7$  1876. Assistant at the Studsgaard Experiment Station from 1908.
- Pedersen, C. C. M.*, Agr. Grad., b.  $^6/_18$  1868. Assistant at the Aarslev Experiment Station from 1906.
- Pedersen, J. Chr.*, b.  $^7/_12$  1884. Assistant at the Hornum Experiment Station 1916—23, at Askov (Lundgaard) from 1923.
- Pedersen, Marius*, b.  $^4/_14$  1889. Assistant at the Moor Experiments, Herning, 1918—20.
- Pedersen, R. P. M.*, Agr. Grad., b.  $^2/_14$  1887. Assistant at the Studsgaard Experiment Station 1914—16. From 1919 manager of the branch office of the Danish Agricultural Societies' Seed Supply Co., Skanderborg.
- Petersen, E. J.*, Mag. Sc., b.  $^{11}/_4$  1894. Department Manager at the State Laboratory for Plant Culture, from 1923.
- Rasmussen, L.*, Agr. Grad., b.  $^1/_14$  1885. Assistant at the Studsgaard Experiment Station 1913—14. From 1919 Advising Specialist in Plant Culture to the Associated Agricultural Societies of the Seeland Province.
- Ravn, F. Kølpin*, Dr. phil., b.  $^5/_10$  1873. Advising Specialist in Plant Disease to the Associated Danish Agricultural Societies 1905—13. Experiment Leader of the State Phytopathological Experiments 1905—19. From 1907 Professor at the Royal Agricultural College. Died  $^5/_25$  1920.
- Rostrup, E.*, Dr. phil., b.  $^1/_28$  1831. Secretary of the Society for the Improvement of Cultivated Plants 1879—93. Editor of the Tidsskrift for Landbrugets Planteavl 1893—1907. From 1883 Docent, 1889 Lecturer and 1902 Professor in Plant Pathology at the Royal Agricultural College. Died  $^1/_16$  1907.
- Rostrup, Sofie*, Mag. Sc., b.  $^8/_7$  1857. Zoologist to the Phytopathological Experiments of the Associated Danish Agricultural Societies 1907—13, to the State Phytopathological Experimental Department 1913—19. Department Manager same from 1919.
- Stenbæk, H.*, Hort. Grad., b.  $^1/_2$  1879. Assistant at the Lyngby Experiment Station 1901—04. From 1907 Professor at the Royal Agricultural College. Died  $^6/_8$  1908.

- Stenbæk, Kr.*, b.  $11/2$  1871. Assistant at the Askov Experiment Station from 1891.
- Svendsen, S.*, Agr. Grad., b.  $4/19$  1890. Assistant at the Tylstrup Experiment Station from 1914.
- Sylvest, J.*, Agr. Grad., b.  $1/25$  1889. Assistant at the Tylstrup Experiment Station 1914—15. From 1917 superintendent of the Langeland Seed-culture Co. Inc., Rudkøbing.
- Sørensen, Hakon*, Hort. Grad., b.  $4/28$  1884. Experiment Leader at the Hornum Experiment Station from 1920.
- Sørensen, R.*, b.  $9/15$  1886. Assistant at the Blangsted Experiment Station from 1918.
- Thorborg, Alvilda*, b.  $10/26$  1889. Assistant at the State Laboratory for Plant Culture from 1921.
- Thyssen, Niels*, b.  $6/2$  1878. Assistant at the Tylstrup Experiment Station 1907—10. From 1910 independent farmer, Kærsgaard by Tylstrup.
- Vestergaard, H. A. B.*, Agr. Grad., b.  $9/25$  1872. Manager of the Abed Experiment Station from 1903.
- Weber, Anna*, Hort. Grad., b.  $12/26$  1893. Assistant at the State Phytopathological Experiment Department from 1920.
- Øhlers, H.*, b.  $8/31$  1890. Assistant at the State Phytopathological Experiment Department from 1913.

### List

of the reports and leaflets published by the State Experimental Department for Plant Culture.

#### Reports.

(All the Reports are published in the Tidsskrift for Planteavl).

1. Experiments with Several Varieties of Rye, Vol. I, 1895, pp. 1—130.
2. Experiments with the Cultivation of Varieties and Strains of Roots, Vol. VII, 1901, pp. 158—92 and Tables pp. 1—82.
3. Experiments with the Cultivation of Home-grown Strains of Roots in 1900, Vol. VIII, 1902, pp. 137—66.
4. Experiments with the Cultivation of Potatoes at the State Experiment Stations 1881—98, Vol. VIII, 1902, pp. 167—234, and Tables pp. 1—54.
5. Experiments with the Cultivation of Home-grown Strains of Roots made at the State Experiment Stations in 1901, Vol. IX, 1902, pp. 169—202.
6. Experiments with the Cultivation of Different Varieties of Oats at the State Experiment Stations, Vol. IX, 1902, pp. 203—61.
7. Experiments with Red Clover, Alsike Clover, White Clover, Kidney Vetch, Lady's Slipper, Snail Trefoil, and Lucern at the State Experiment Stations 1880—99, Vol. X, 1903, pp. 159—323 (with summary of the results, Vol. XI, pp. 1—20).
8. Third-year Experiments with the Cultivation of Strains of Roots at the State Experiment Stations in 1902, Vol. XI, 1904, pp. 1—20.
9. Fourth-year Experiments with the Cultivation of Strains of Roots at the State Experiment Stations in 1903, Vol. XI, 1904, pp. 324—64.

The following Reports are on sale at the book-dealers for the price indicated.

10. Results of Experiments with the Cultivation of Potato Varieties, Vol. XII, 1905, pp. 180—207. 50 Øre.
11. Fifth-year Experiments with the Cultivation of the Strains of Roots, Vol. XII, 1905, pp. 295—329. 50 Øre.
12. Results of Experiments with the Cultivation of Large, Small and Cut Tubers Planted at Different Distances, Vol. XII, 1905, pp. 432—72. 65 Øre.

13. Experiments with Supplementary Sowing of Unsuccessful Lay Fields and Experiments with a Lay in Rye, Vol. XIII, 1906, pp. 49—78. 50 Øre.
14. Sixth-year Experiments with the Cultivation of Strains of Roots, Vol. XIII, 1906, pp. 199—234. 50 Øre.
15. Investigations on the Nitrogen Content of Liquid Manure in the Different Parts of the Liquid Manure Tank, Vol. XIII, 1906, pp. 235—50. 25 Øre.
16. Results of Comparative Investigations of Methods for Determining Content of Dry Matter in Potatoes, Vol. XIII, 1906, pp. 316—38. 65 Øre.
17. Experiments with the Wintering of Mangolds, Vol. XIII, 1906, pp. 339—70. 50 Øre, with Supplement, Vol. XIV, 1907, pp. 571—84. 65 Øre.
18. Experiments with Time of Sowing and Amount Sown as Applied to Rye, Vol. XIII, 1906, pp. 371—400. 50 Øre.
19. Ten Years Experiments with the Cultivation of Rye Varieties, Vol. XIV, 1907, pp. 45—150. 1 Kr.
20. Various Experiments with the Cultivation of Roots, Vol. XIV, 1907, pp. 208—39. 50 Øre.
21. Seventh Year Experiments with the Cultivation of Strains of Roots, Vol. XIV, 1907, pp. 240—75. 50 Øre.
22. Investigations of Liquid Manure with Special Regard to the Loss of Nitrogenous Matter Under Storage, Vol. XIV, 1907, pp. 276—91. 25 Øre.
23. Experiments with Varieties of Roots, Vol. XIV, 1907, pp. 327—64. 50 Øre.
24. Experiments with the Cultivation of Winter Wheat, Vol. XIV, 1907, pp. 365—465. 1 Kr.
25. Experiments with Change of Seed, Vol. XIV, 1907, pp. 479—514. 50 Øre.
26. Investigations of Solid and Liquid Manure from Farms in Jutland and Seeland, Vol. XIV, 1907, pp. 515—70. 65 Øre.
27. Experiments with Amounts of Seed Sown Using Different Varieties of Grasses in Pure Stock, 1882—95, Vol. XIV, 1907, pp. 585—98. 25 Øre.
28. Twenty Years' Experiments in Cultivating Leguminous Plants to Maturity, Vol. XV, 1908, pp. 1—93. 1 Kr.
29. A Method for Determining Ammonium in Stable and Liquid Manure. Described by R. K. Kristensen, Assistant at the Askov Experiment Station, Vol. XV, 1908, pp. 94—108. 25 Øre.
30. Experiments with the Yield of Seed of Varying Nitrogen Content, Vol. XV, 1908, pp. 109—130. 25 Øre.
31. An Analytical Investigation of the Botanical Composition of Annual and Perennial Grass-fields, 1877—1888. State Adviser P. Nielsen, Vol. XV, 1908, pp. 185—312. 1 Kr.
32. Eighth Year Experiments with the Cultivation of Strains of Roots, Vol. XV, 1908, pp. 313—43. 50 Øre.
33. Experiments with Species of Rye and Wheat, Vol. XV, 1908, pp. 355—82. 50 Øre.
34. Soil Investigations of the Experiment Areas at Aarslev Experiment Station, Vol. XV, 1908, pp. 383—406. 50 Øre.
35. Experiments with Ways of Harvesting Hay, Vol. XV, 1908, pp. 407—16. 25 Øre.
36. The Botanical Composition of the Herbage of Pasture Land Used in Various Ways. An Analytical Investigation by E. Lindhard, Vol. XV, 1908, pp. 467—508. 50 Øre.
37. Experiments with Time of Sowing and Amount Sown as Applied to Oats, Vol. XV, 1908, pp. 509—26. 25 Øre.
38. Twenty-one Years' Experiments with the Cultivation of Varieties of Two-rowed Barley, Vol. XVI, 1909, pp. 1—74. 80 Øre.
39. Formation of New Barley Varieties, Especially Tystofte Prentice Barley. N. P. Nielsen, Vol. XVI, 1909, pp. 169—93. 50 Øre.

40. Twenty-three Years' Experiments with the Cultivation of Varieties of Six-rowed Barley, Vol. XVI, 1909, pp. 194—242. 65 Øre.
41. Ninth Year Experiments with the Cultivation of Strains of Roots, Vol. XVI, 1909, pp. 243—82. 50 Øre.
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#### Leaflets.

The following leaflets, with the exception of the B leaflets have appeared in Agricultural Journals and the Daily Press and by degrees in the Tidsskrift for Planteavl. Where numbers are omitted it is because they are out of date.

(A) Signifies Leaflets of Experimental Results, (B) Leaflets of Instructions.

11. Results of Experiments with the Cultivation of Large and Small Potatoes at Various Distances. Pub. March 25, 1904, Vol. 12, pp. 77, Second Edition August, 1910.
12. Results of Experiments Using Whole and Cut Tubers in Cultivation. Pub. May 6, 1904, Vol. 12, p. 80, Second Edition, August, 1910.
14. Supplementary Sowing of the Lay Fields. Pub. August 24, 1904. Vol. XII, p. 83.
16. Results of Experiments with Time of Sowing as Applied to Rye. Pub. September 7, 1905. Vol. XIV, p. 469. Second Edition, August, 1910.
18. Results of Experiments with Time of Sowing as Applied to Oats. Pub. March 22, 1906. Vol. XIV, p. 474. Second Edition, August, 1910; Third Edition, March, 1919.
20. Results of Experiments with the Wintering of Mangolds. Pub. September 20, 1906. Vol. XV, p. 183. Second Supplementary Edition, August, 1910. Third Edition, March, 1919.
21. Results of Experiments in Cultivating Peas and Horsebeans. Pub. March 21, 1907. Second Edition, September, 1908. Vol. XVI, p. 151.
22. Results of Experiments with the Cultivation of Seed for Stable Fodder Mixtures Sown at Various Times. Pub. March 27, 1907. Vol. XVI, p. 155.

23. Results of Various Experiments with the Cultivation of Roots. Pub. April 11, 1907. Vol. XVI, p. 159. Second Edition, August, 1910.
25. Results of Investigations on the Content of Nitrogenous Substance in Liquid Manure Under Various Conditions. Pub. July 25, 1907, Vol. XVII, p. 164. Second Edition, November, 1910.
30. Results of Experiments in Cutting Lucern, Two, Three or Four Times Annually on Good Lucern Soil. Pub. August 6, 1908. Vol. XVII, p. 351. Second Edition, March 1919.
31. Combatting Weeds with Green Vitriol. Pub. February, 18, 1909. Vol. XVII, p. 353. Second Edition, April, 1915.
35. Results of Experiments with Potatoes Planted at Various Times and at Various Depths. Pub. March 24, 1910. Vol. XVIII, p. 402.
37. Experiments with the Yield of Red Clover of Various Origin 1898—1910. Pub. March 16, 1911, Vol. XVIII, p. 406.
38. Seed Production of Cock's-foot Grass. Preliminary Results of Experiments with Various Methods of Sowing and Quantities of Seed Sown. Pub. March 23, 1911. Vol. XIX, p. 305.
39. Seed Production of Bird's-foot Trefoil. Results of Preliminary Experiments with the Influence of the Amount of Seed Sown on the Yield in Seed as well as Experiments with Producing Seed from the First or Second Cutting. Pub. March 30, 1911. Vol. XIX, p. 307.
40. Experiments with the Yield of Fodder-Lucern of Various Origin, 1901—1910. Pub. May 18, 1911. Vol. XIX, p. 309.
41. Results of Experiments with Varieties of Rye, 1905—1910. Pub. July 27, 1911. Vol. XIX, p. 310.
42. Results of Experiments with the Cultivation of Mixed Grain to Maturity. Pub. December 1, 1911. Vol. XIX, p. 313. Second Edition, March, 1919.
43. Experiments with the Cultivation of Early Potatoes. Pub. March 15, 1912. Vol. XIX, p. 318.
44. Experiments with the Yield of Alsike Clover, White Clover, and Yellow Trefoil of Various Origin. Pub. March 22, 1912. Vol. XIX, p. 320.
45. Experiments with Thinning out and Distances Between the Rows of Roots. Pub. April 19, 1912. Vol. XIX, p. 323.
47. Seventeen Years Experiments with Stable Manure and Artificial Fertilizers at Askov Experiment Station, 1894—1910. Pub. January 30, 1913. Vol. XX, p. 744. Second Edition, March, 1919.
48. Experiments with Varieties of Turnips for Summer Stable Fodder. Pub. March 14, 1913. Vol. XX, p. 749.
49. Results of Thirteen Years' Experiments with Stable Manure, Applied in Various Amounts at Various Times with and without Liquid Manure to the Experiment Fields at Askov, 1898—1910. Pub. March 28, 1913. Vol. XX, p. 752.
50. Six Years' Experiments with Different Varieties of Winter Wheat, 1907—1912. Pub. August 1, 1913. Vol. XX, p. 755.
51. Results of Experiments with the Cultivation of Different Varieties of Oats, 1908—1912. Pub. March 13, 1914. Vol. XXI, p. 309.
52. Experiments with Different Varieties of Barley, 1907—1912. Pub. March 20, 1914. Vol. XXI, p. 309.
55. Experiments with Varieties of Potatoes, 1904—1911. Pub. April 8, 1914. Vol. XXI, p. 744.
58. Experiments with the Wintering of Swedes, Pub. October 2, 1914, Vol. XXI, p. 755.
59. Experiments with Sowing Sugar Beets at Different Times, 1908—1913. Pub. January 22, 1915. Vol. XXII, p. 714.
60. Baking Bread from Various Ryes. Pub. February 19, 1915. Vol. XXII, p. 715.
61. Experiments in Thinning-out Roots. Pub. March 26, 1915, Vol. XXII, p. 718.

62. Preserving Boiled Potatoes for Summer Fodder. Pub. December 10, 1915. Vol. XXIII, p. 778.
65. Experiments with the Cultivation of Serradela and Two Cut Red Clover in Oat Fields for Green Fodder, 1910—1916. Pub. March 30, 1917. Vol. XXIV, p. 614.
66. Experiments with Root-tops as Fertilizer. Pub. October 18, 1917, Vol. XXIV, p. 616.
67. Experiments with Fallow and Green Manure on the Sandy Field at Askov Experiment Station, 1888—1914. Pub. March 15, 1918. Vol. XXVII, p. 377.
68. Experiments with Yellow and Blue Lupines Sown at Various Times for Seed-production, 1894—1902. Pub. March 27, 1918. Vol. XXVII, p. 380.
70. Experiments to Test the Influence of the Time of Cutting on the Size of the Crop and the Fodder Value of Hay. Pub. May 9, 1918. Vol. XXVII, p. 383.
71. Experiments with Varieties of Gooseberries, Currants and Black Currants (A). Pub. March 18, 1920. Vol. XXVII, p. 385.
72. Experiments with Agriculture on High Peat Bog. Application of Different Mineral Soils and Fertilizers. (A). Pub. March 25, 1920. Vol. XXVII, p. 388.
73. Experiments with Different Varieties of Two-rowed Barley, 1913—1916. (A). Pub. March 31, 1920, Vol. XXVII, p. 391.
74. Experiments with Different Varieties of White Winter Cabbage 1917—1919 (A). Pub. June 24, 1920. Vol. XXVII, p. 393.
75. Experiments with the Preservation of Fruit in Cellars and Cold Storage Rooms. (A). Pub. July 1, 1920. Vol. XXVII, p. 395.
76. Leaf Curl of Carrots. (B). Pub. March 1921. Vol. XXVIII, p. 62.
77. Leaf Roll of Potato. (B). Pub. March 1921. Vol. XXVIII, p. 64.
78. Smut of Winter Rye and Wheat. (B). Pub. March 1921. Vol. XXVIII, p. 66.
79. Smut of Oats and Barley. (B). Pub. March 1921. Vol. XXVIII, p. 70.
80. *Pleospora graminea* of Barley. (B). Pub. March 1921. Vol. XXVIII, p. 73.
81. Experiments with Varieties of Strawberries. (A). Pub. March 31, 1921. Vol. XXVIII, p. 75.
82. Some Results from the First Eight Years Manure Experiments at the Aarslev Experiment Station, 1911—1918. (A). Pub. March 31, 1921. Vol. XXVIII, p. 78.
83. Flea-beetles and Methods for their Control. (B). Pub. May 1921, Vol. XXVIII, p. 81.
84. The Biology and Control of the Cabbage Maggot. (B). Pub. May 1921. Vol. XXVIII, p. 84.
85. Late-blight of Potato (*Phytophthora infestans*). (B). Pub. May 1921. Vol. XXVIII, p. 88.
86. Gooseberry Mildew. (B). Pub. May 1921. Vol. XXVIII, p. 92.
87. Inoculation of Leguminous Plants. (B). Pub. February 1922. Vol. XXVIII, p. 537.
88. Artificial Irrigation of Garden and Field Crops. (A). Pub. April 20, 1922. Vol. XXVIII, p. 540.
89. Spraying Apple- and Other Kernel-fruit Trees. (B). Pub. May 1922. Vol. XXVIII, p. 544.
90. Experiments with Varieties and Strains of Bush Marrow Peas, 1919—1921. (A). Pub. June 15, 1922. Vol. XXVIII, p. 548.
91. The Biology and Control of the Beet-leaf Miner. (B). Pub. June, 1922. Vol. XXVIII, p. 550.
92. The Biology and Control of the Scavenger Beetle. (B). Pub. June, 1922. Vol. XXVIII, p. 553.
93. The Biology and Control of the Oat Nematodes. (B). Pub. June 1922. Vol. XXVIII, p. 557.

94. Dry Spot of Oats. (B). July 1922. Vol. XXVIII, p. 561.
95. Club Root Disease (*Plasmodiophora brassica*). (B). Pub. July 1922. Vol. XXVIII, p. 563.
96. Experiments with Varieties and Strains of Garden Carrots. 1919—1921. (A). Pub. October 12, 1922. Vol. XXVIII, p. 566.
97. Experiments with Varieties and Strains of Red Beets, 1919—1921. (A). Pub. October 19, 1922. Vol. XXVIII, p. 568.
98. Experiments with the Germination of the Seed of Mangolds in the Field. (A). Pub. February 1, 1923. Vol. XXIX, p. 633.
99. Experiments with New Varieties of German Potatoes. 1921—1922. (A). Pub. March 1, 1923. Vol. XXIX, p. 635.
100. Spraying as a Remedy for Capsides on Apple-Trees. (A). Pub. April 19, 1923. Vol. XXIX, p. 636.
101. The Influence of Lee Planting on the Growth and Yield of Fruit Trees. (A). Pub. June 28, 1923. Vol. XXIX, p. 640.
102. The Preservation of Apples and Pears. (A). Pub. July 15, 1923. Vol. XXIX, p. 641.
103. Experiments with the Disinfection of Rye and Wheat. (A). Pub. August 23, 1923.
104. Wart Disease of Potato. (B). Pub. October 1923.
105. Experiments with Strains of Tomatoes to be Grown in the Open. 1919—1921. (A). Pub. October 12, 1923.
106. The Influence of Lee Planting on the Yield and Time of Maturing of Strawberries. (A). Pub. November 8, 1923.

#### Key to the Soil Map, p. 126.

The terms applied to soils on the map, which shows the natural conditions present in the upper layer are taken from a survey map drawn by Professor *C. F. A. Tuxen* in the 90's. This has been revised recently, the provinces of Southern Jutland supplemented from *L. Meyn's* geological survey map, and the Faroe Islands from the ordnance map.

The term clayey soils indicates: good, predominantly clayey loam soils (clayey loam mixed with sand).

- » » sandy soils: light, predominantly sandy loam soils, (sandy loam mixed with clay).
- » » heath-soils: stretches of heath with very poor sandy soils, now or formerly, with heather growth.
- » » moor-soils: high- and low-bog, meadow and bog soils.
- » » marsh-soils: sand and clayey marsh, clayey soils.
- » » sea-bed formations: raised sea-level and embanked areas.
- » » dunes: drifting sand.
- » » The State Experiment Stations and Experiment Divisions are located on soils corresponding to the special problems studied. (see pp. 109—110).