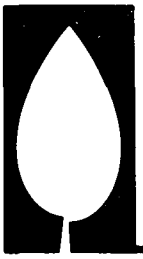
Danish Research Service
for Plant and Soil Sience

Plant diseases, pests and weeds in Denmark 1985

102nd annual report
Compiled by
The Research Centre for Plant Protection

Lyngby 1988



Danish Research Service
for Plant and Soil Sience

Plant diseases, pests and weeds in Denmark 1985

102nd annual report
Compiled by
The Research Centre for Plant Protection

Lyngby 1988

Contents Page

A. INSTITUTE OF PLANT PATHOLOGY

I. GENERAL SURVEY OF PLANT PATHOLOGY SUBJECTS 1985, H. Rønde Kristensen

In 1985 32 research workers and a technical and administrative staff of 35 people were employed at the Institute of Plant Pathology.

Besides, 7 students working on their theses, 8 laboratory apprentices and 1 craftsman, the latter working under the government employment scheme, participated in the work of the institute.

At the Botany Department, Mogens Houmøller was employed from the beginning of 1985 (a project initiated by the Joint Committee for Agricultural Research and Experiments). At the same time Lilian Kloster was employed on a part time basis (as a biologist working under the government employment scheme) at the Botany Department.

Henning Mygind entered his resignation by the end of the year after 34 years of employment at the State Plant Pathology Institute (later the Institute of Plant Pathology).

At the Virology Department, Morten Heide was employed from the 1st of February (a project initiated by the Joint Committee for Agricultural Research and Experiments) and from the 1st of July Lise Hertz Jørgensen was employed as a biologist working under the government employment scheme also at the same department.

From the 1st of February, Fritjof Lind was on the permanent staff of the Zoology Department as a research worker. Mogens Juhl, who was employed at the Zoology Department since 1960, died in December.

At the Advisory Service, Ole Bagger resigned on the 1st of March after 23 years of employment; he was replaced by Ghita Cordsen Nielsen on the 1st of June.

At the Botany Department, the investigations of bacterial ringrot in potatoes have aimed at securing that the potato meristem programme should be free of this disease.

Experiments concerning the spread of bacterial ring rot (in potato fields) have been finished.

bacteriological examinations of several important pot plant cultures have been continued in connection with the production of healthy nuclear plants.

As was the case in previous years numerous plant and stubble samples from cereals were examined for attacks by take-all and eyespot, and more than 1000 isolates of the eyespot fungus were examined for carbendazim resistance.

The computer programmes Epidan and Cerco have been developed further, so that reliable prognoses are within the range of possibility (after additional testing).

Observations concerning frost damage in winter barley and the spread of mildew from winter barley to spring barley are currently performed.

Investigations concerning the injury threshold criteria for mildew and other pests in cereals also continued.

In 1985, investigations on the virulensgene spectrum of powdery mildew on wheat and barley in this country were started (a project initiated by the Joint Committee for Agricultural Research and Experiments).

Potato wart tests, which are made for the potato breeding station at Vandel and for the Government Plant Protection Service, continued.

In the crucifers, experiments regarding correct timing of control for the most important fungal diseases in rape have been finished. Furthermore a method for the testing of variety susceptibility to stem rot fungus has been carried out.

Within the greenhouse sphere the work carried out by the Botany Department has comprised, among other things, a registration of the physiological strains of downy mildew of lettuce, and, as was the case in previous years, a considerable work has been done testing for vascular fungi in connection with the establishment of healthy nuclear plants.

Determination of serious pests in sour cherry (a project initiated by the Joint Committee for Agricultural Research and Experiments) was continued.

At the Zoology Department, the usual routine examinations for potato cyst nematodes continued. These examinations are mainly carried out on samples taken by the Government Plant Protection Service - mainly from seed potato fields, but also from fields grown with other crops.

Several soil samples from the experimental and advisory activities were examined for cereal and beet cyst nematodes.

By means of special examinations, efforts have been made to try to throw light

on the importance of the cereal cyst nematode as a growth inhibitor in spring wheat and on its population dynamics in fields with cereals grown in monoculture.

Investigations concerning biological control of pests in greenhouses were continued and the same applies to the development of testing methods for the demonstration of the effects of pesticides on pests and beneficial arthropods.

As a basis for a control guidance and for the preparation of "Plant Protection Bulletins" registrations have been made of aphids, rust and mildew in the spring barley fields of a large number of growers. With a view to the determination of injury thresholds for aphid attacks, regular registrations of the density of aphids in experiments with winter wheat and spring barley have been carried out.

In order to be able to give advice as to a determination of the correct time for haulm desiccation, aphids registrations have also been made in potatoes (by means of yellow traps).

In rape a nation-wide registration of the occurrence of various pests has been made - based partly on traps, partly on plant samples.

At the Zoology Department various investigations have been made of pests in peas, seed grass, carrots, cabbage and strawberries.

At the Virology Department, as was the case in previous years, numerous electron microscopic examinations have been carried out - most of them using the ISEM-method.

Thanks to the employment of a new research worker it has been possible to expand and intensify the serological and biochemical work. The serological methods used comprise precipitation, agglutination, gel diffusion, ELISA, and "Dot Immuno Binding".

When serology cannot be used, electrophoresis (agarose electrophoresis and polyacrylamide electrophoresis) is applied.

In 1985, the serum bank at the department was computerized.

In co-operation with the Institute of Seed Pathology efforts have been made to develop methods for a virus testing of seeds.

At the Virology Department, examinations for possible virus attacks in rye grass, maize, peas and wheat have been made in co-operation with the Advisory Service.

Furthermore, efforts have been made to register the distribution of cocksfoot mottle virus.

In 1985, many winter barley fields and beet fields were examined for the occurrence of barley yellow mosaic and rhizomania, respectively, and for the vectors of these diseases (*Polymyxa* spp.).

In connection with the production of healthy potato meristem cultures extensive testings for virus diseases have been made, and the possibilities of preserving foundation material in test tubes have been examined.

Examinations also continued of the susceptibility of different potato varieties to rattle virus.

Within the field of horticultural plants a substantial part of the work focused on the establishment of virus free nuclear material (by means of thermotherapy and tissue culture) of a great number of plant species - herbaceous as well as ligneous.

In this work, examinations are made to find the growth media which are most suitable for the various plant species, especially with a view to the content of cytokinin and auxin.

Furthermore, temperature experiments were carried out with meristem cultures in the rooting phase, and also experiments with preservation of ligneous plants in test tubes were made.

During 1985, FAO and members of the staff of the Virology Department have collaborated on the production of a video on the Danish potato meristem programme.

The video programme, which is to be used for educational purposes in developing countries, has a playing time of 2 1/2 hours (divided into sections).

As an innovation at the Institute of Plant Pathology a new unit was established in 1985, a biotechnological project with Ib Dinesen as the day-to-day head of department.

The project has employed 4 research workers and 3 laboratory assistants in 1985.

The programme comprises the development of methods for the production of disease free and resistant horticultural and agricultural plants, and for the time being it deals with tissue cultures in barley and rape, cell suspension cultures of pot plants and acclimatization of tissue cultures and the isolation of fungal toxins.

Advisory work

In 1985, the staff at the Institute of Plant Pathology prepared 143 publications and gave 166 lectures.

International co-operation.

In 1985 the staff at the Institute of Plant Pathology made 51 journeys to the following countries: Belgium, England, Finland, France, Germany, Greece, Holland, Hungary, Israel, Italy, Marocco, Norway, Sweden, and the U.S.A.

The following subjects were treated during these travels: Bacterial ringrot in potatoes and other bacterial diseases, resistance biology of cereals, seed bacteriology, integrated plant protection of field-grown vegetables, cyst nematodes, integrated and biological control of greenhouse crops, leafminers and their parasites, pesticides and beneficial arthropodes, electron microscopy, resently developed methods of diagnosis of viruses, diagnosis of plant diseases, barley yellow mosaic and Rhizomania, virus in fruit trees and bushes, propagation and health control, fruit tree virus and tissue culture and in-vitro problems in connection with mass production of horticultural plants.

In 1985 guests from the following countries have visited the Intitute of Plant Pathology:

Australia, Belgium, Burma, Canada, China, Cuba, Czechoslovakia, Egypt, England, France, Germany, Greece, Holland, India, Indonesia, Ireland, Israel, Jugoslavia, Marocco, New Zealand, Nigeria, North Korea, Norway, Pakistan, Peru, Poland, Somalia, Sudan, Sweden, Switzerland, Taiwan, Tanzania, U.S.A., Zimbabwe.

The Plant Health Control and propagation of healthy plants.

In 1985, as in previous years, the Plant Health Council dealt with a great number of pests and diseases and their prevention/control, legislatively and through other measures.

During the past year the Colorado beetle was found in one place only, viz. in a private garden, where 22 beetles and 1000 larvae were found. The favourable situation in 1985 must be seen as a reflection of the comprehensive control efforts made by the Government Plant Protection Service in 1983 and 1984.
Dutch elm disease spread more rapidly in 1985 than the year before. The situation was most severe in the areas of the cities of Vejle and Århus, and from there the disease spread west and north as far as the region of Himmerland. The disease did not spread so rapidly in the islands of Funen and Sealand. It is considered impossible to eradicate the disease, but the spreading may be delayed considerably by removing the attacked trees immediately.

At the same time, advisory work concerning the disease will still be done, e.g. by means of information about which trees can replace elms in the case of replantation and afforestation.

The potato meristem programme has in 1985 continued satisfactorily. With few exceptions all potatoes, which were used for the propagation of seed potatoes, originated from the meristem programme, and from 1986 all seed potatoes used for commercial agriculture (for the production of seed potatoes, potatoes for consumption and potatoes for industrial use) should be "meristem potatoes".

The Plant Health Council has also discussed drafts for a new legislation concerning the fungus-borne virus barley yellow mosaic and Rhizomania: negotiations on these diseases are awaiting results from EEC-discussions on Rhizomania and have therefore not concluded.

Furthermore, a draft for a Government order on red core in strawberries (*Phytophthora fragariae*) and health control regulations for tissue culture and changes in the Government orders on winter barley have been discussed.

Within the Nursery Control Commission certain changes of structure have taken place in 1985. The number of contact groups was reduced to two, viz. a propagation committee for field-grown plants and a propagation committee for greenhouse plants: The two committees have the same chairman (for the time being: The Director of the Institute of Plant Pathology), and there are representatives from the institutes of horticulture and from the Institute of Plant Pathology on the committees.

In 1985, the statutory health control comprised 2285 enterprises to which the Government Plant Protection Service made 6571 inspection visits.

Most of the attacks found via the growth inspections were of pests (68% of the attacks), but the total number of attacks have declined considerably.

New proposals forwarded to the committees on propagation during the year comprise a total of 48 propagation tasks (in 32 plant genera).

In EPPO (the European Plant Protection Organization) the deputy director general Dr. G. Mathys, resigned by the 31st of December 1985, after 17 years, and vice managing director, I. Smith, was temporarily appointed to the post until he was elected director general at the council meeting in September 1986, carrying a great majority.

II. ADVISORY WORK AT LYNGBY.

Ole Bagger (till 1st of March), Hellfried Schulz (till 1st of June) and Ghita Cordsen Nielsen (from 1st of June)

Main tasks

The plant pathological advisory service, including telephone inquiries, diagnoses of diseases in plant samples, preparation of forecasts and warnings and of the Monthly Survey of Plant Diseases. The work also includes participation in all relevant seminars, meetings, symposia, etc..

Information in 1985

The advisers received the following bulletins and warnings:

6th February	Control of mildew and rust in winter barley
6th February	Information on staff changes
21st March	Abnormal sprouts in winter barley
21st March	Be aware of cereal cyst nematodes
17th April	Control of mildew and rust in winter barley
30th April	Eyespot in winter rye
14th May	The migration of frit flies
14th May	Eyespot in winter wheat
20th May	Examination of peach potato aphids in beet pits
23rd May	Control of mildew and rust in winter rye
24th May	The egglaying of the cabbage root fly
28th May	The migration of the 1st generation of the brassica pod midge
29th May	Forecast of attacks by sclerotinia disease in winter rape
29th May	Mildew in cereals
14th June	Leaf diseases and aphids in cereals, etc.
20th June	Aphids and mildew in spring barley
25th June	Cutworms
25th June	Forecast of attacks by sclerotinia disease in spring rape
25th June	Pea moths
27th June	The migration of the 2nd generation of the brassica pod midge
1st July	Warning against late blight
3rd July	Forecast of attacks by sclerotinia in spring rape
4th July	Aphids in beets
10th July	The 2nd generation of the frit fly
10th July	Pea moths
10th July	The effect of pyrethroids on aphids in barley
10th July	The egglaying of the cabbage root fly
11th July	Aphids in beet

16th July	Cutworms
18th July	Aphids in beet
19th July	The 2nd warning against late blight
25th July	Aphids in beet
14th August	The migration of frit flies
9th September	The migration of the 3rd generation of the frit fly
23th August	Inquiry form concerning the Plant Protection Bulletins
28th October	Attacks by slugs in winter crops
5th November	Future use of benzimidazoles
8th November	Forecast of eyespot in winter cereals

With a view to the Monthly Survey of Plant Diseases a collection was organized in cooperation with the other departments of 150 pea and rape samples for an examination for sclerotinia and other fungal diseases.

In 1985, as an innovation, the Monthly Surveys of Plant Diseases were sent out as Plant Protection Bulletins on the following dates: 7th May, 7th June, 5th July, 7th August, 5th September, 4th October, and 5th November.

These monthly surveys were sent to 341 colleagues and 26 professional journals and newspapers. Besides, the Monthly Surveys were sent to 195 subscribers in Denmark and the rest of the world.

As for titles and authors see the list of publications.

522 persons participated in 11 plant pathological excursions. A total of 7 lectures were given at meetings and seminars.

Weather conditions (Jørgen Olesen, Agral Meteorological Service).

In January the weather was very cold with mean temperatures 5.4 degrees below normal. At the beginning of January there was snowfall and very cold air invaded the country from north-east, so that the mean temperature was -26 degrees in North-western Jutland around the 7th. The cold continued with minor interruptions until the end of the month.

At the beginning of February the weather was mild and rainy. A cold period started around the 7th with large parts of the country without snow cover. When the cold period was ending around the 23rd, the frost penetrated deeply into the ground.

March was very wet with only little sun. The number of hours with sun was less than half normal. The cloudy and not very sunny weather gave rise to considerably

smaller 24-hours variations of the temperature than usual.

In April the changable and not very sunny weather continued. About the 15th, however, the weather became somewhat milder and dry with sunshine. On the 26th - 27th a depression followed by sleet and snow invaded the country from the north. During the last days of the month the weather was very cold with some sunshine.

The first 5 days of May were very cold with changable weather and local snowfall. During the rest of the month the weather was sunny and mostly dry, so that the mean temperature for the month as a whole was a little above average and the rainfall somewhat below average. In coastal areas low temperatures were registered during the day on several occasions because of cool sea water.

In June the weather was mostly cool and somewhat changable with rainfall a little above normal. The temperature was 1.2 degrees below normal. Genuine summer temperatures occurred only during the first 5 days of the month.

The changeable weather continued in July. However, the first half of the month was relatively dry with few summer days, but the last part was rainy and relatively cool.

The weather in August was also mostly changeable with rain and thunderstorms from south-west. Only for a few days around the 14th and the 30th summer weather occurred with temperatures around 25 degrees.

In September the weather was mostly cool and not very sunny with temperatures for the month as a whole 1.0 degree below average. In Jutland the rainfall was above average, whereas precipitation was normal in the rest of the country.

October was relatively warm and dry with temperatures for the month as a whole 1.4 degrees above average. Genuinely rainy weather occurred only a few days around the 8th. Thus rainfall was much below average. By the end of the month widespread night frost was registered.

In November the weather was mostly cool and cold with genuine winter weather in the last part of the month. The mean temperature of the month was 3 degrees below normal. Around the 24th - 25th dry and cold air invaded the country from the north followed by snow showers. During the rest of the month the weather was dominated by snow and frost. Due to a clear, windless weather and snow cover very low temperatures were registered by the end of the month.

In December the weather was mostly mild with record rainfall. The average rainfall

in Jutland and the Islands was 140 mm, the normal average being 55 mm. Genuine winter weather with frost occurred only during the first and the last days of the month.

For the preparation of this survey I have used weekly reports on precipitation, etc. sent out by the Meteorological Office.

	Temperature °C		No. of sunny hours	
	1985	Normal	1985	Normal
January	-5.5	-0.1	58	41
February	-4.1	-0.4	85	65
March	1.2	1.6	60	127
April	5.0	6.1	109	181
May	11.4	11.1	240	256
June	13.2	14.4	212	257
July	15.8	16.5	217	247
August	15.6	16.2	202	221
September	12.0	13.0	125	166
October	10.0	8.6	102	98
November	1.9	4.9	58	42
December	2.6	2.1	16	28
Annual average	6.6	7.8		
Hours in all			1484	1729

	Precipitation in mm		Deviations from normal		
	1985	normal	Jutland	Island	Bornholm
January	46	55	-10	-7	27
February	23	39	-17	-14	-17
March	55	34	19	27	2
April	59	39	21	18	6
May	32	38	-7	-3	21
June	54	48	3	11	-10
July	82	74	6	13	-8
August	95	81	18	6	7
September	81	72	14	-3	0
October	35	70	-35	-34	-45
November	62	60	0	7	3
December	140	55	92	85	62
Total precipitation	764	665	104	106	48

1. Diseases in agricultural plants 1985

Ghita Cordsen Nielsen

Cereals and Grasses

Overwintering of winter crops and grasses. The most widespread frost damage in recent years occurred. The cause was severe black frost and no isolating snow-cover. Especially in the period 7th - 19th February, black frost occurred, which lasted for several days.

Winter barley suffered the most severe damage and about 80% of the area had to be resown, especially on the light soils. From several localities, Western Sealand among others, there were reports of a total resowing of a whole region. The best overwintering was seen in Lolland-Falster and in Eastern Jutland. The six-row cultivars did well, including 'Hasso', 'Mammut' and 'Tapir', whereas the two-row cultivars, 'Igri' and 'Panda' came out badly. **Snow rot** (*Typhula incarnata*) and **snow mould** (*Gerlachia nivalis*) must be considered as secondary diseases.

The overwintering of winter wheat was satisfactory. However, a total of 10% of the area had to be resown, but with great variations. Generally, the cultivar 'Kraka' overwintered satisfactorily, but a few localities were completely destroyed by frost, especially on light soils and on soils, with winter wheat following grass. Especially the English fodder wheat cultivars were damaged by frost (Longbow, Imba, Norman) and triticale cultivars.

The overwintering of rye was satisfactory in most places - less than 0.5% of the area had to be resown. Especially in Bornholm the rye was damaged, but it was caused by snow mould (*Gerlachia nivalis*). In January and February, the crops in Bornholm were covered by an isolating snow-cover.

In seed grass fields the overwintering of rye grass was unsatisfactory, especially in the case of Italian rye grass. The advisers estimated that on a national scale approximately 60% of the area had suffered frost damage. Unsatisfactory overwintering of clover grass fields was seen especially in fields with two successive crops of clover, with red-clover and rye grass suffering the severest damage. The advisers estimated that an average of approximately 7% and 11% of fields with grass crops following other crops and fields with grass following grass, respectively, had suffered frost damage.

Later in the growing season a weak development of roots and physiogenic spots were observed in some winter crops, probably caused by bad wintering. Compensatory rooting in winter wheat was also observed. Furthermore, barren spikelets, which may be caused by cold weather and water deficiency (poorly

developed roots).

Storm damage. Storm and hail on the 6th and 7th September caused great losses of seed and grain in several areas. Hail caused only a small part of the loss. On a national scale the yield loss was estimated to amount to 3 - 4% for cereal crops.

Grey speck (manganese deficiency) was observed in winter crops and spring barley in several fields, but only weak to medium severe attacks were seen. The symptoms are usually observed in dry and loose soils.

Yellow tip disease (copper deficiency). Only few cases were seen and the attacks were weak.

Barley yellow mosaic virus has not been observed in winter barley fields i 1985. However, the fungus *Polymyxa graminis* which transmits the virus has proved to be widespread in Danish soils.

Eyespot (*Pseudocercosporella herpotrichoides*). The possibilities of infection were generally better in 1984/85 than in 1983/84, especially in Jutland. At the beginning of December weak attacks on rye and wheat were observed.

The forecast of attacks of eyespot in rye was sent out on the 30th of April. There seemed to be a need for control in 60% of the rye fields, which was a little more than the year before.

The forecast of attacks in wheat was sent out on the 14th of May. There seemed to be a need for control in 50% of the fields.

The advisers reported of attacks in some rye and wheat fields, but with weak attacks and few medium severe attacks. In many localities the plants showed poorly developed roots after the winter. Generally, the attack was weaker than the year before.

Take-all (*Gaeumannomyces graminis*). The attacks must be described as weak in 1985.

Mildew (*Erysiphe graminis*). Concerning the severity of attacks in the rest of the winter barley and winter wheat fields the advisers reported on mainly weak attacks and attacks in few fields in May. The wheat cultivars 'Kanzler' and 'Disponent' suffered more severe attacks than 'Kraka', 'Anja' and 'Vuka'. There were also weak attacks in spring barley in May. Attacks were observed in less than 10% of the fields. Many spring barley fields were sown rather late due to extensive resowing.

In June attacks in winter barley and winter wheat were still weak, but with more severe attacks in some wheat fields. About 1/3 of the advisers reported of medium severe attacks in spring barley and very little or no mildew in resistant cultivars, such as 'Jenny' and 'Taarn'. Compared to the year before the attacks of mildew in cereals developed slower this year.

In July the attacks in winter wheat and spring barley were still described as mostly weak, but widespread. In 1985, attacks were weak with considerable differences between the cultivars, especially in spring barley.

Yellow rust (*Puccinia striiformis*) was observed only sporadically, and with weak attacks. In a few exceptional cases it was necessary to control the disease. From Lolland-Falster there were reports of few more severe attacks.

Brown rust of wheat (*Puccinia recondita*) was not very widespread and occurred only with weak attacks.

Brown rust of barley (*Puccinia hordei*) was generally observed with only weak, sporadic attacks.

Net blotch (Drechslera teres). The attacks in spring and winter barley were not very widespread and very weak.

Leaf blotch of barley (*Rhynchosporium secalis*). The attack in spring barley was very weak and occurred in few fields. 84% of the advisers reported of 0% attacks in spring barley fields. In winter barley the attacks were a little more severe.

Loose smut (*Ustilago nuda f. sp. hordei*) occurred in some fields, especially in spring barley, but only with few smutted ears. In a few cultivars attacks were more severe, e.g. in the cultivar 'Jenny'. However, the attacks were of no economical importance. In June, 23% of the advisers characterized the attack in spring barley as medium severe.

Stinking smut (*Tilletia caries*). There were no reports of attacks in wheat.

Speckled leaf spot (*Septoria tritici*) was rather widespread, as it is usually the case in the early spring, but with weak attacks, which disappeared when temperatures rose, and the micro climate became less wet.

Glume blotch of wheat (*Septoria nodorum*) generally occurred with weak attacks and mostly on the lower leaves. In 98% of the cases there were no or weak attacks.

Brown foot rot and ear blight (*Fusarium* spp.) was seen together with **grey mould** (*Botrytis cinerea*) in some fields rather late in the growing season, often in cultivars with short straws. The grains were undeveloped and an orange mycelium was often seen.

Fungal diseases in seed grasses. Mildew and to a smaller extent leaf spot and rust were seen in some cultivars. The attacks were generally weak. From Møn there were reports of a severe case of rust and powdery mildew in meadow grass.

Legumes

Grey mould (*Botrytis cinerea*) was the prominent fungal disease in peas in 1985. In June, when the weather was rather cold, there were reports of grey mould in a small part of the pea fields, but with weak attacks only. In July, which was very wet, there were reports of several medium severe attacks, whereas nearly half the advisers reported of severe attacks of grey mould in August. In several areas rainfall in August and to some extent in July was far above average. Especially cultivars with a large foliage were attacked by fungi. Due to excessive rainfall the time of harvest was much delayed.

At one time there was doubt as to the use of the peas for forage due to the fungal attack. In most cases the fear proved unfounded.

Chocolate spot (*Botrytis cinerea*) was found in some broad bean fields, but mostly with weak to medium attacks. In August there were reports of severe attacks in Midwest Sealand and Eastern Jutland - probably the agressive phase. In September there were reports of severe attacks in Western Jutland.

Leaf, stem and pod spot (*Ascochyta* spp.) generally occurred with very weak attacks. In June 83% of the advisers reported that leaf, stem and pod spot did not exist in the fields. In August the attacks were still considered generally weak to medium severe (83% of the cases). However, 2 advisers from Funen and Jutland reported of severe attacks in their areas caused by excessive rainfall. The attacks occurred very late in 1985 unlike 1982 with early attacks. The late attack was probably caused by the very low average temperature in June and July.

Leaf and pod spot (*Ascochyta fabae*) was not widespread and only weak attacks were seen. From Western Jutland, however, an adviser reported of severe attacks.

Downy mildew (*Peronospora pisi*) was far less widespread and occurred with less severity than grey mould. Unlike grey mould, downy mildew occurred mainly in limited areas and with more severe attacks, f.inst. in the area of Salling.

Fusarium wilt (*Fusarium oxysporum* f. sp. *pisi*) occurred only sporadically and with weak attacks.

Clover rot (*Sclerotinia trifoliorum*) occurred with weak attacks only.

Oilseed Rape

Overwintering of oilseed rape. Fields with too small plants suffered most damage. According to an average of the estimates sent in by the advisers, on a nation-wide scale approximately 12% of the winter rape area showed frost damage caused by black frost.

Boron deficiency. In July rape plants with black wilted tops were received. Soil samples revealed low occurrence of boron in the fields.

Sclerotinia disease (*Sclerotinia sclerotiorum*). On the 29th of May a warning was sent out against attacks by the fungus in some winter rape fields in Funen and in the Northern and Eastern parts of Jutland. The fungus attacked fields, where rape had been grown before. However, control was not necessary in all fields, as, after all, the formation of the apothecia had taken place at a late stage compared to the flowering of winter rape. In spring rape warnings of control were send out on the 25th of June in the areas of Horsens, Haderslev and Ring-sted. Due to extensive frost damage in the winter crops many spring rape fields were established rather late (late flowering). This gave rise to the second warning on the 3rd of July for control in spring rape, this time in the areas of Horsens, Haderslev, Ringsted, and some rape fields in the areas of Holbæk and Næstved.

In June, July and August only very weak attacks of stem rot in winter and spring rape were seen. However, in the areas of Midwestern Sealand, Funen and Northern Jutland severe attacks in spring rape were seen in August. In a few cases it was necessary to expedite the time for laying in swaths in the spring rape.

There were no reports of attacks by sclerotinia disease in peas. An examination carried out by the the Research Centre for Plant Protection in 1985 showed a high frequency of sclerotia of the fungus in pea samples.

Clubroot (*Plasmodiophora brassicae*). In spring rape, "no attack" was stated in 67% of the reports. 6 advisers, however, reported of severe attacks of clubroot in spring rape in the areas of Midwestern Sealand (3), Northern Jutland (2), Funen (1).

Dark leaf and pod spot (*Alternaria brassicae, A. brassicicola*). Generally weak attacks which became more widespread in the last part of the growth season,

when temperatures rose.

Grey mould (*Botrytis cinerea*) was found in a small part of the fields and with weak attacks. The fungus also appeared with primary attacks and was mistaken for sclerotinia disease.

Dry rot and canker (*Phoma lingam*) occurred sporadically with weak attacks. The fungus was found in winter rape only - obviously, its cycle does not match the development of spring rape.

Root crops

a) Beet

Overwintering of seed beet. The frost caused damage to crops. There were reports of widespread and severe attacks from 42% of the advisers.

Damage in pits. Approximately 10% of the group described with widespread/severe damage were caused by frost which gave rise to putrefaction or too much heat caused by a thick snowcover.

Speckled yellows (manganese deficiency). The attack in beet was described as weak.

Magnesium deficiency. The attack was observed as no or a weak attack. The summer of 1986 was relatively rainy, and magnesium and boron deficiency problems are most pronounced under dry conditions.

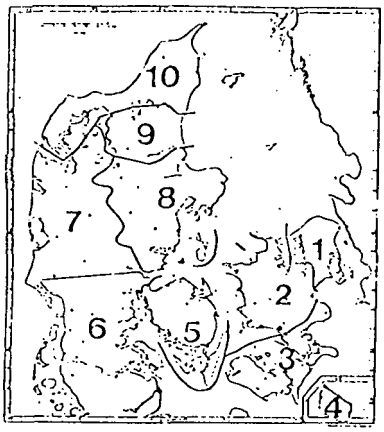
Heart rot and dry rot (boron deficiency). There were reports of few weak cases only.

Violet root rot (*Rhizoctonia crocorum*) was not widespread and occurred with very weak attacks.

Virus yellows (Beta virus 4). Examinations of late pits (15th May and 1st June) and pits with peach potato aphids showed that east of the Great Belt there were no peach potato aphids in the pits examined. Also, there were few late pits. In Jutland, especially in the areas 7-8 (see illustration) the picture was different. There were a large number of pits on 15th May and 1st June. Generally, the occurrence of peach potato aphids was widespread in the pits. However, reports from the advisers in June showed that virus yellows appeared only sporadicallly and with weak attacks. In July all of the 63 advisers reported that 0% of the

beet fields were attacked by virus yellows in their areas. In August, 84% of the advisers described attacks of virus yellows as none or weak. Only 3 advisers reported of severe attacks (Western Jutland, Eastern Jutland and Northern Jutland).

The attacks of virus yellows occurred late in 1985. In September, however, there were reports of several totally yellow beet fields, especially in the areas of Jutland with many late and infected pits. In September, there were reports of weak attacks from Sealand, Lolland-Falster, Bornholm and part of Funen.



Regions

1. North Sealand
2. Central and West Sealand
3. South Sealand, Lolland, Faster
4. Bornholm
5. Funen
6. South Jutland
7. West Jutland
8. East Jutland
9. Himmerland
10. North Jutland

Black leg (*Phoma betae, Pythium* spp., *Aphanomyces cochlioides* and others) was generally widespread. There were weak to medium severe attacks and only few cases of severe attacks.

Powdery mildew (*Erysiphe betae*) was seen only in few places with insignificant attacks because of wet weather. Also the attacks occurred very late.

Ramularia leaf spot (*Ramularia beticola*), **Cercospora leaf spot** (*Cercospora beticola*) and **rust** (*Uromyces betae*) were found only sporadically with weak attacks.

b) Potatoes

Potato pits - overwintering. Approximately 9% of the reports described the damage as widespread/severe.

Potato leaf roll (*Solanum* virus 14) and **streak** (*Solanum* virus 2) were less widespread and occurred with weak attacks.

Rattle virus was not very widespread and occurred with no or little severity.

Black leg (*Erwinia carotovora* var. *atroseptica*) was seen in several fields with weak attacks in 76% of the cases.
Wet rot (*Bacteriosis*) of tubers was not very widespread and occurred with weak attacks.

Wart disease (*Synchytrium endobioticum*). 2 new attacks in gardens were detected in the autumn 1985. The Government Plant Protection Service has lifted some of the inhibitive zones, so that only 7 remain.

Common scab (*Streptomyces scabies*). The attack on tubers was widespread, but was seen mostly with weak to medium severity.

Black scurf and stem canker (*Rhizoctonia solani*) occurred in weak to medium severity in many fields.

Late blight (*Phytophthora infestans*). The first warning was sent out on the 1st July, and the first attacks were found the week after. The 2nd warning of epidemic occurrence of late blight was sent out on the 19th July. In August the severity of the attacks was described as weak to medium in 83% of the cases. In August the attack spread especially into varieties grown for industrial use. This attack was very widespread and more widespread than in previous years, due to the excessive rainfall in August - September which made control of the disease difficult, and the spores had been washed down to the tubers. The fungus spores can live in humid soil for up to 1 month.

2. Pests in agricultural plants 1985

Ghita Cordsen Nielsen

Cereals and grasses

Cereal cyst nematodes (*Heterodera avenae*). In June, 18% of the advisers reported of medium severe to severe attacks, whereas, in July, the attacks were described as weak to medium severe. At the Research Centre for Plant Protection an examination of about 250 spring barley fields was carried out which showed that there were an unacceptable large number of nematodes in approximately 40% of the fields.

Bird-cherry aphids (*Rhopalosiphum padi*) and **grain aphids** (*Sitobion avenae*). The first aphids were seen in spring barley late in May, especially in the southern part of the country. In June, the attacks in spring barley were described as moderate, but generally widespread. Out of 72 reports, however, 12 cases were described as medium severe to severe attacks. In July, the aphid attacks were generally described as no or weak attacks. However, there were a few severe attacks in winter wheat and spring barley, especially in the southern parts of the country. In experiments carried out with a large number of aphids yield increases of up to 16 hkg/ha were obtained. Especially at high N-levels the aphids were persevering. In 1985, the parazitation of the aphids occurred rather late. The grain aphid, as so often before, was the dominant species.

Grain thrips (*Limothrips cerealium* and *L. denticornis*). Several cases of grain thrips attacks were found in 1985. The characteristic white sheaths were seen especially in rye. In June, 13% of the advisers reported of medium severe to severe attacks, whereas the general reports were of no or weak attacks. In an experiment with rye infested by many thrips a yield increase of 4.0 hkg/ha was obtained after control.

Wireworms (*Agriotes* spp.). Both the extension and the severity of the attacks were limited. 85% report of no attack.

Leatherjackets (*Tipula paludosa*). The attacks were widespread in Jutland - especially in Southern Jutland, Northern Schleswig and Central Jutland. On Sealand there were limited attacks. Leatherjackets often occur in connection with spring barley and beet following ploughed grass.

Italian rye grass in pure culture was also severely attacked, and it was necessary to resow in several cases.

The reports described the severity of the attacks as "no" (18%), "weak" (16%), "medium strong" (37%), and "severe" (29%). According to the weather conditions in the autumn and soil samples taken, weak attacks are expected in 1986.

Frit flies (*Oscinella frit*). The first generation migrated in the week 20th to 27th May, which was later than usual. This was caused by the very cold spring. Due to the hard winter the population was expected to drop.

The migration of the first generation differed significantly from one locality to the other, but was generally weak. On the 10th of July warnings against the second generation were sent out. This generation, however, took a long time because excessive rainfall hampered the migration, and the rather low temperatures delayed the hatching.

The 3rd as well as the 2nd generation were smaller than usual.

The attacks of both the 1st, 2nd and 3rd generation were weak in 1985, and they were smaller in number than in 1984.

Saddle gall midges (*Haplodiplosis equestris*). There were reports of weak attacks only. So far there is nothing indicating a fresh outbreak of this pest.

Leaf beetles (*Oulema melanopus*) occurred with weak to medium severe attacks. (*Ochsenheimeria vaculella*) was found in spring barley in North-western Sealand. Experiences with this pest which causes blasted spikelets are still limited.

Wheat gall midges (*Contarinia tritici* and *Sitodiplosis mosellana*). Attacks in wheat were insignificant.

Bibionid flies (*Bibio hortulanus*). Extension and attacks were very limited.

Potato stem borers (*Hydraecia micacea*). One attack in maize was reported. The attack was confined to the edge of the field.

Slugs (*Agriolimax* spp.). In September - October there were many reports of severe attacks in winter cereal crops and winter rape. Resowing was necessary in several cases. Especially where winter cereal crops and winter rape followed rape, peas, clover and grass there were reports of attacks. Heavy, lumpy types of soil sown by means of the rotor harrow system had severe attacks. The large slug population was ascribed to the favourable conditions for reproduction under rather wet and cold weather conditions during late summer and autumn.

Legumes

Cabbage thrips (*Thrips angusticeps*). Attacks were widespread in Central and Southern Sealand and in Northern Jutland. The severity of the attack was generally weak (78% of the reports). Only in one locality severe attacks were found.

Pea thrips (*Kakothrips pisivorus*). In July the attacks were described as none or weak.

Pea and bean weevils (*Sitona lineatus*). The occurrence was widespread, especially in Central and Southern Sealand, on Funen and in Central Jutland. In these areas the attacks were described as weak (61%), medium strong (29%) and severe (5%).

Severe attacks by adults were seen on leaves, whereas the damage to root nodules by larvae could not be detected immediately. Severe larval attacks may result in yellow wilted leaves, which may look like N-deficiency, because the larvae eat the N-containing root nodules.

In August there were reports of weak to medium severe attacks by pea and bean weevils in clover. 3 advisers reported of severe attacks. In September 61% of the advisers reported of medium severe attacks. Severe attacks were seen in Western Jutland (3 reports), Funen (2), Lolland-Falster/Southeast Sealand (2), Central and Western Sealand (1).

Control of pea and bean weevils in weak white-clover was necessary in several cases. With low temperatures in October the pea and bean weevils hibernated.

1985 was the 2nd year in a row with severe attacks of pea and bean weevils in the late summer in clover, probably due to a considerable increase in the areas grown with peas, in which the pea and bean weevils can be reproduced and attack the clover after the peas have been harvested.

Tortrix moth caterpillars (*Cnephasia* spp.) were generally widespread in peas in some areas, but there were only 3 reports of medium severe attacks. In broad beans there were only few and weak attacks by tortrix moth caterpillars.

Pea aphids (*Acyrthosiphon pisum*). In June pea aphids had only spread very little, and attacks were weak. In July 27% reported of medium severe attacks, and pea aphids were generally widespread. In August the attack and the spread had decreased, but there were few rather late, severe attacks.

Black bean aphids (*Aphis fabae*) in field beans were generally widespread and occurred in July with medium severe attacks i 9 out of 21 reports.

Pea moths (*Cydia nigricana*). Migration was so low this year, that control of pea moths was not necessary. 4 plant protection bulletins on the pea moth were sent out. During the first week of June there were pea moths in 2 out of 180 traps distributed all over the country. Beginning and Mid July pea moths were on the wings in approximately 15% of the localities. It was not possible to detect any difference in migration from one region to another by looking at the figures. Only the migration activity was higher on Sealand in June and July (50% of the localities with initial migration), and partly in Jutland (West, East, Northern Jutland).

Reports from the advisers also showed weak attacks in June, July and August.

Flower weevils (*Apion* spp.) in clover occurred in few fields and generally with weak attacks. Only from Northern Jutland there were reports of severe attacks.

Oilseed rape

Blossom beetles (*Meligethes aeneus*) were widespread in winter rape fields in May. The cold weather at the beginning of May hampered the migration of blossom beetles so much that attacks in winter rape were moderate. Later in the month the temperature rose, and in June when the spring rape is flowering the attacks were described by 70% of the advisers as widespread and with medium severe to severe attacks.

Seed weevils (*Ceutorrhynchus assimilis*). By the end of May the main part of the winter rape fields had been infested by the seed weevils with varying severity. Almost half of the advisers estimated the attacks as medium severe.

The ocurrence of seed weevils, as was the case for brassica pod midges, was also very widespread in June and more than half of the advisers estimated the attacks as medium severe. In July, apart from few severe attacks, only weak to medium severe attacks were seen in winter rape and no or weak attacks in spring rape.

Brassica pod midges (*Dasyneura brassicae*). The brassica pod midge migrated by the end of May. On the 28th of May warning against the 1st generation of the brassica pod midge was sent out and control was necessary approximately 5 days later.

The overwintering conditions for the brassica pod midge were good in 1984/85. Therefore there was a risk of moderate to severe attacks in areas which the year before had had a large population of brassica pod midges (North Schleswig, Northern Funen and Southern Sealand). In June there were reports of very widespread attacks by brassica pod midges in winter rape with medium severe

attacks in more than half of the reports. In July the attacks were generally weak to medium with few severe attacks, however. In spring rape there were generally no or weak attacks.

There were reports of insufficient control of brassica pod midges in spite of several sprayings with pyrethroids, probably because the control was applied too late or due to a vigorous vegetation (combined with a large density of brassica pod midges) resulting in quicker dilution of pyrethroids in the rape plants than usual.

Warning against the second generation of brassica pod midges was sent out on the 27th of June. In most places evidence of the occurrence of the first generation of brassica pod midges was found in winter rape. In fields with insufficient control the attacks were severe (30 - 40% of the pods were destroyed.

Flea beetles (*Phyllotreta* spp.). Spread and attacks were very limited.

Cabbage stem flea beetles (*Psylliodes chrysocephala*) did not cause problems, one adviser in Southern Sealand, however, decribed the attack as medium strong.

Cabbage thrips (*Thrips angusticeps*) did not cause problems in winter rape. In spring rape the occurrence was moderate all over the country. In a few places in Southern Sealand there were cabbage thrips in most of the fields. In May, the attacks were estimated as weak (68%) or medium severe (21%), whereas one adviser reports on severe attacks. The spread and the attacks seemed to be more severe than in 1984.

Cabbage stem weevils (*Ceutorrhynchus quadridens*). There were generally no or weak attacks. However, there were several cases of severe attacks. The cabbage stem weevil attracted more attention in 1985 than in previous years. The light, wilted stems that the cabbage stem weevil leaves behind, were in a few cases mistaken for symptoms of sclerotinia disease.

Cabbage root flies and **turnip root flies** (*Delia radicum, D. floralis*) occurred in winter and spring rape with only few attacks of no or weak strength.

Diamond-back moths (*Plutella xylostella*) occurred very sporadically and was of no importance.

Swede gall midges (*Contarinia nasturtii*). 34 advisers observed no attacks, while 10 advisers saw weak attacks and only one reported on medium severe attacks.

Cabbage butterflies (*Pieris brassicae, P. rapae*). There were few weak attacks.

Cabbage aphids (*Brevicoryne brassicae*) was less widespread and with weak attacks.

Root crops.

a) Beet

Beet nematodes (*Heterodera schachtii*). Only 5 reported of occurrences - there were both weak and severe attacks.

Cabbage thrips (*Thrips angusticeps*). As in 1984 there were widespread attacks in beet in 1985. However, the attacks were much weaker, and resowing was unnecessary.

In May, approximately 40 advisers estimated the extent and damaging effects of the following pests (percentage):

PESTS	ATTACKS			
	no	weak	medium	severe
Wireworms	22	64	11	3
Pygmy beetles	58	39	3	0
Collembola	71	21	8	0
Millipedes	76	24	0	0
Beet leaf miners	71	11	14	4

Pygmy beetles (*Atomaria linearis*) occurred as in 1984 in a few fields, where the individual cases gave rise to damage.

Beet leaf miners (*Pegomyia hyoscyami*). Spread and severity was in May as in previous years, and it was found in approximately 20% of the fields, of which a few had severe attacks. In August 4 advisers had seen severe attacks.

Beet carrion beetles (*Blitophaga opaca*) was more widespread than in 1984, but only 8 advisers out of 69 reported of medium strong attacks.

Tortrix moth larvae (*Cnephasia* spp.) were widespread, but only 3 advisers saw medium strong attacks.

Nut meg moth (*Dicestra trifolii*) and **cabbage moth** (*Mamestra brassicae*) occurred in several fields, but with weak attacks. Even though the nut meg moths prefer dry conditions they occurred with severe attacks in Northern Jutland. 1985 is the third year in a row with severe attacks by larvae of the nut meg moth in beet in Northern Jutland.

Cutworms (*Agrotis segetum*). Due to the wet weather conditions, attacks were less widespread and generally weak.

Peach potato aphids (*Myzus persicae*) and **black bean aphids** (*Aphis fabae*). In 1985, 7 plant protection bulletins concerning aphids in beet were sent out in June - July.

The bulletins were based on reports from the advisers on the number of peach potato aphids and black bean aphids registered in beet fields all over the country.

At the beginning of July a warning was sent out for control of peach potato aphids on Møn, Southern Sealand and Lolland-Falster. One week later control was necessary on Funen. From several areas too little information had been sent in during this period as to the number of peach potato aphids in the fields examined, and therefore it was not possible to estimate the need for control, if any. Especially from areas with many late and infested beet pits reports were few.
Out of 40 spindle tree localities examined in the spring, black bean aphids occurred in 3 localities. In 1984, no overwintered eggs were found on spindle trees.

At the beginning of June, black bean aphids were widespread in the southern parts of the country and from the end of June until the beginning of July there were widespread, but weak attacks in most parts. By the end of June and as late as by the end of July there were severe attacks on the islands and in the southern parts of the country, at that time there were no signs of parasiting yet. Control caused some problems in the southern parts. Also in the experiments the bad effect of several of the systemic phosphorous agents was observed, perhaps due to resistance developing.

The black bean aphids occurred late in 1985, but with rather severe, late attacks on the islands and in the southern parts of the country.

b) Potatoes

Potato cyst nematodes (*Heterodera rostochiensis*). Two advisers reported of attacks.

Cutworms (*Agrotis segetum*). The turnip moths migrated later this year than usual- not until 10th July did the pheromone traps catch many animals.

Considering the rainfall and temperature conditions, severe attacks by cutworms were not expected. A plant protection bulletin was sent out on the 25th of June. On the 16th of July the second plant protection bulletin was sent out. The catch of turnip moths decreased in Sealand and Funen. On Samsø a decrease late in

June was followed by a considerable increase in catches. In Jutland catches were generally large except in Southern Jutland.

Colorado beetles (*Leptinotarsa decemlineata*) were observed in 1985 with severe attacks in a new locality, a private garden in Lolland-Falster. They had probably overwintered from 1984. Also from Tønder there were reports of the occurrence of 19 summer beetles in a private garden. In 1985 there were a total of 4 reports on the occurrence of colorado beetles.

3. Diseases and pests of horticultural plants 1985

(Lars A. Hobolth)

Variations are few in the percentual distribution of enquiries when compared to an average of the five preceding years (table 1). The enquiries tend, however, to be directed more towards specific subjects, and so the number of enquiries on mycology, bacteriology, virology and zoology has increased a little.

Table 1.

Percentual distribution of registered enquiries

	Phy-siogenical	Myco-logical	Bacte-riological	Viro-logical	Zoo-logical	Di-verse	Unex-plained
Average of 5 years 1980-84	14.8	41.8	7.5	4.9	24.5	5.8	0.6
1985 (total number: 1672)	10.1	44.2	9.2	6.0	27.2	3.7	0.06

Climatic damage

When spring was well advanced, many trees and bushes showed signs of injuries caused by the winter. Many roses, both the old plants and the grafted ones died. Apparently the grafted plants that had been ridged up after the grafting had taken place suffered fewest injuries.

Many tulips were damaged by too much ethylen, possibly due to the cold stores having been too carefully locked to keep out the cold.

The late spring hampered the development of chinese cabbage when it was planted out, so that many plants formed flowers before heads. Because of the cold weather in June many outdoor cultures requiring warm weather stopped developing. This was the case f.inst. of sweet corn, large cucumber and gherkins. In strawberries the weather resulted in an insufficient pollination of the berries, and this explains the large number of deformed strawberries found. Later in the summer several local hailstorms caused damage to various crops. In onion the skin was damaged so that different fungi gained access to the onion.

Fungal diseases

Clubroot (*Plasmodiophora brassicae*) is still found now and then in plantlets. The symptoms often appear so late that the plants have already been planted in the field, before the symptoms can be seen. Considering the vigorous development of the fungus in the course of one to two weeks after the planting had taken place there can be no doubt that they were infected already during the germination. As seed transmission of this disease is not known of, suspicion must be directed towards the cultivation medium. Infected fields have been found, where the previous crop was not cabbage but other cruciferae crops, for instance oilseed rape and mustard. These crops may cause problems, because attacks must be very severe to be detected, as the roots are not lifted during the harvest, which would reveal the typical swellings of the roots.

Pythium spp. destroys the roots of many glasshouse cultures. The slightest imperfection of the cultivation is often the beginning of an attack of the fungi. This could be a too compact standard soil, causing the roots to suffocate, or a temporary imperfection of the irrigation system, creating a conductivity so high that the roots are destroyed at the slightest drying up of the soil.

Phytophthora spp. is just as widespread as *Pythium* in pot plant nurseries. This fungus is often detected more quickly, because frequently it is developing up into the plants, so that the infection can be seen over the soil surface, and the injuries caused by it are more drastic than those caused by *Pythium*.

Leathery rot (*Pytophthora cactorum*) was found several times in strawberry cultures. The typical symptom is a number of brownish, coriaceous berries in the clusters.

White Tip of leek (*Phytophthora porri*) is a common disease in many leek cultures, perhaps because this culture, like many other cultures, is grown in an insufficient crop rotation.

Downy mildew of onion (*Peronospora destructor*) was found somewhat later in 1985 than was the case the preceding year. The extension of the attack seems to indicate that the common method of cultivating this crop with onions set very near sown onions leads to more severe attacks by this fungus.

Downy mildew of cabbage (*Peronospora parasitica*) was fairly widespread in the autumn. In cauliflower, infection could be found even in the heads, where thin blackish brown stripes appeared. Often the stripes radiate from the ramifications of the sprigs.

Downy mildew of lettuce (*Bremia lactucae*) is often found both in outdoor and

glasshouse crops. In many cases it would be possible to limit the problem by using cultivars, which are resistant to the strain(s) found there.

Downy mildew of peas (*Peronospora viciae* f.sp. *pisi*) was found late in the summer in many pea cultures both in peas for the green market trade and for the industry. There may be a connection between the more widespread attacks and the fact that more peas are grown.

Apple scab (*Venturia inaequalis*) has not been very widespread in commercial orchards, probably due to all the attention paid to this fungus in 1983, when it was almost impossible to control it.

Powdery mildew of strawberry (*Sphaerotheca macularis*). There were very severe attacks in many fields. In some cases the attacks in Zefyr were so widespread that picking was given up, because the berries were completely covered by the fungus.

American gooseberry mildew (*Sphaerotheca mors-uvae*) In private gardens this fungus is very common in gooseberries, whereas, in commercial plantations, it causes much damage in black currant.

Anthracnose (*Gnomonia veneta*) **of Platanus** was widespread in small trees, whereas only seldom the attacks in large trees were of importance.

Neck Rot (*Botrytis allii*) occurred with severe attacks in Egyptian onions. The big onions after planted onions, in particular, were infected. A contributary factor to the severe attacks has been the weather causing the onions to stop growing very late. Late in the winter many onions were found to be infected, but the outbreak did not come until the onions were made ready for sale.

Grey mould (*Botrytis cinerea*) is one of the most common fungi both in outdoor and glasshouse crops. In pot plants in glasshouses f.inst. *Eustoma*, *Solanum* and *Begonia*, the attack is often found in the root neck, thereby causing the top to die, whereas the root appears to be intact. In tomatoes and cucumber attacks were found already early in the season. This must be explained by the wet spring.

Outdoors severe attacks were found in strawberries. Yields decreased very much where a careful treatment of the plants had not taken place.

(Fusarium spp) attacks many different cultures. The worst damage is seen in Egyptian onions resulting in great number of missing plants in many fields. Attacks have also occurred in asparagus, celery and peas. In glasshouse crops attacks have been found in melon and tomatoes. In pot plants, particularly *Hibiscus*,

Schefflera and *Dracaena*, attacks have been widespread.

Rust in asparagus (*Puccinia asparagi*) A few severe attacks have been found both in plants being raised and in established cultures.

White-rot (*Sclerotium cepivorum*) **in onion.** Unlike 1984 this fungus has not been very widespread this year. The less severe attacks may be explained partly by a better sowing material, partly by the weather.

Sclerotinia rot (*Sclerotinia sclerotiorum*) is now found in many different cultures, both in glasshouse and outdoor crops. In glasshouse crops attacks have been found in melon, among other crops, and in outdoor crops attacks have been seen in carrots and celery. The spread of attacks in the cultures indicates that they come from few sclerotinia, which have been lying in the ground, and which have germinated with hyphase.

Pests in horticultural plants

Stem nematodes (*Ditylenchus dipsaci*) have been found at rare occasions in not healthy strawberry cultures. Futhermore the pest has been registered in garlic intended for planting. The occurrence in garlic can probably be explained by the fact that the material used for sowing has not been selected carefully enough.

Strawberry nematodes (*Aphelenchoides fragariae*) occur in many strawberry cultures. particularly in plant material which is not changed regularly.

Thrips (*Thysanoptera*) are getting a very widespread pest both in glasshouse and outdoor crops. In glasshouses the young shoots in cucumber cultures are often injured by thrips. Thrips are also a serious pest in pot plants, and damage has been registered in *Schefflera*, palms and *Hibiscus*. Outdoors many different plants are injured, roses, leaks and cornflower for instance may often be attacked.

Strawberry mites (*Steneotarsonemus pallidus*) are a widespread pest in a strawberry cultures where some plants are not thriving.

Gall mites (*Eriophyes*) have been found in different cultures, such as pear, plum, hazel and elder.

Attacks of gall mites (*Cecidophyosis hendersonii*) have been found several times in Yucca. The first signs of an attack in this plant are a floury cover on the surface of the leaves. When the mites develop the leaves will get brown.

Froghoppers (*Cercopidae*) indirectly cause some damage in strawberries, as the foam is hampering the work of the pickers, who will have to clean the hands

when they have touched it.

Garden chafers (*Phyllopertha horticola*) are still occurring with severe attacks in Mid-Jutland, where the migration of the imago takes place every year around Constitution Day (5th June).

Blossom beetles (*Meligethes aeneus*) attack in the autumn in many different plants. In nurseries, the blossom beetles gnaw of the surface of the heads of cauliflower.

Diamond-back moths (*Plutella xylostella*) attacked cauliflower, and at an early stage it could cause damage to the main shoot.

Gooseberry pyralids (*Zophodia convotutella*) are widespread in private gardens attacking currant and black currant. In many cases, apparently, they have been mistaken for currant moths (*Lampronia capittella*).

African Cotton leafworm (*Spodoptera littoralis*). One single attack was detected in *Cissus rhombifolia*. Eggs or small larvae of the African cotton leafworm have been imported with seedlings from the areas around the eastern part of the Mediterranean.

Frit flies (*Oscinella frit*) were found in scattered attacks in sugar maize. As the fly is very dependent on the development of the plants, it does happen that some growers have all the plants from one sowing time destroyed, whereas plants which have been sown at an earlier or later date are not attacked.

III. BOTANY DEPARTMENT, Ib G. Dinesen, Acting Head of Dept.

Bacterial diseases (Ib G. Dinesen and Karen Jørgensen)

Diseases in potato

The number of samples to be examined for potato ringrot was very limited in 1985. Most of the material examined was meristem plants produced at the Virology Department. Approximately 500 samples were examined for the Government Plant Protection Service.

The examinations, which were initiated last year in order to establish the spread of potato ringrot in the field, were finished, and the results show that the spread was rather large in the field.

Fireblight (*Erwinia amylovora*)

The forecast model for fireblight was related to observations of fireblight in hawthorn hedges. Countings were carried out at Hornum and in Central Sealand.

The production of healthy nuclear stock plants

In connection with the renewal of nuclear stock plants at the Institute of Glasshouse Crops the bases of cuttings were examined for plant-pathogenic bacteria: *Kalanchoë blossfeldiana* and *Dieffenbachia maculata* were examined for *Erwinia chrysanthemi* and *Pelargonium hortorum* for *Xanthomonas pelargonii*. All the samples were free from plant-pathogenic bacteria.

Hedera helix: The nuclear stock plants are examined at the Institute of Glasshouse Crops to see whether they are still free from *Xanthomonas hederae*.

Begonia hiemalis: The purification by meristem production of *Begonia elatior* hybrids was fairly extensive in 1985. The tube plants were examined twice for *Xanthomonas begoniae* before delivery to the Institute of Glasshouse Crops. Up til now, 18 varieties have been delivered to Årslev.

Furthermore, the following samples were examined for plant-pathogenic bacteria: *Schefflera* (2 clones), *Crossandra* (3 clones), *Nephrolepis* (4 clones) and pelargonium varieties collected from Norway, Germany and Holland.

Fungal diseases

Take-all (*Gaeumannomyces graminis*)

In 1985 a total of 1665 stubble samples were examined for takeall. The attacks

in spring barley were generally weaker this year than in 1984, and there were significant attacks in only 16% of the fields. In winter barley there were attacks over 20% in 33% of the fields and in winter rye attacks were registered in 4% of the fields. In general, the attacks in winter wheat were a little more severe in 1985, and percentages over 20% were registered in almost 15% of the fields, especially when the crop rotation included many cereals.

Eyespot (*Pseudocercosporella herpotrichoides*)

In spring approximately 469 plant samples of winter crops were examined for attacks by eyespot with a view to developing prognoses, warnings and treatment guidance. Climatic observations and spore counts showed that the possibilities of spread were better this year than in 1984. The main part of the infection probably took place from medio October to medio November.

According to observations the disease could spread in spring at all of the 3 observation localities.

It was estimated that treatment was necessary in 50% of the wheat fields and in 60% of the rye fields.

However, examinations carried out in the summer of 1665 stubble samples showed the same severity as in 1984, with slightly weaker development of symptoms. In 30% of the spring barley fields weak attacks of eyespot were found.

Sharp eyespot (*Rhizoctonia cerealis*) was somewhat less widespread in 1985 than the year before.

Injury thresholds for leaf fungi in cereals (Sten Stetter)

Epidan is a computer programme designed to assess the economy of treatment against leaf diseases in spring barley. The 1985 edition of Epidan was enlarged and improved in the light of the results of experiments carried out in 1984 and were tested in 93 experiments in 1985. These results form the basis of the programme, "Grower registration", which can be used via the agricultural data terminals in 1986.

Cerco is a computer programme for the determination of the need for treatment against eyespot in winter crops and is based on a system worked out by H. Schulz.

The fact that it is designed as a computer programme makes it possible to test the system more accurately, to obtain more reliable prognoses and later to be able to serve a larger number of farmers.
In 1986 it will be tested on old test results and after possible improvements have

been made on new tests in 1987.

Variety mixtures in winter barley (Boldt Welling and M.S. Houmøller)

Experiments with variety mixtures in winter barley has been finished and report no. 3 has been prepared.

The results showed weaker attacks by mildew (*Erysiphe graminis*) and leaf blotch (*Rhynchosporium secalis*) in mixtures compared with the varieties grown as monocultures - the so-called effect of variety mixtures.

Yield increases of up to 4 hkg grain/ha were found in the mixtures. The grain weight was not affected in mixtures. Fungicide treatment with Bayleton 25 WP and Tilt 250 EC had no effect on the mixtures. Compared to the variety mixtures of spring barley, the reduction of mildew attacks was evidently smaller and could not replace the obligatory treatments in winter barley.

The experiments were carried out in cooperation with the Government research station at Rønhave and the Agricultural Plant Department of the Royal Veterinary and Agricultural University. Efforts will be made to try to make the project continue in future.

Winter barley analyses 1985 (Boldt Welling, Jørgen Simonsen and Fynbo Hansen)

Examinations of the inoculum level of mildew in winter barley in connection with 1 and 2 protective treatments have been started. The experiments were made at the research stations at Rønhave, Foulum and Roskilde.

The infection was measured partly in neighbouring spring barley fields and partly by means of trap boxes sown with 'Pallas' barley.

The quality of stored grain (Boldt Welling and A. Idoff)

Examinations have been made in cooperation with the Governmental Committee on Animal Husbandry to register the occurrence of storage fungi in connection with different preservation methods. The results from 1985 were published in report no. 603 from the Governmemt Committee on Animal Husbandry.

Diseases in grass (Boldt Welling and A. Nordestgaard)

In cooperation with A. Nordestgaard, the research station at Roskilde, examinations have been made of the effect of routine fungicide treatments on the occurrence of diseases and the yield in seed grass.

Experiments carried out during 1 year showed little correlation between the occurrence of diseases, yield and fungicide treatments.

The experiments will continue in 1986.

Virulence analyses of powdery mildew on barley and wheat (Mogens S. Houmøller)

In 1985 a 5-year project was initiated by the Joint Committee for Agricultural Research and Experiments to examine the virulence spectra of different cereal pathogens. During the 1st year, powdery mildew on barley and wheat was investigated at 10 localities 3 times during the growing season.

Powdery mildew on barley: The experiments showed that the resistance efficiency of cultivated varieties varied significantly. They varied from 0 to 100% compared to the severity of attacks on the variety 'Pallas', which is highly susceptible to mildew.

The frequencies of the Ru, Ty, and "ml-o" virulences were low, i.e. the corresponding resistance of similar varieties was efficient against the majority of Danish mildew populations. However, the Sp, W, and La virulences occurred with frequencies near 100, which means that the resistant genes of similar varieties were of no importance to Danish mildew.

Mildew on wheat: Polpular wheat varieties such af 'Kraka', 'Anja', 'Vuka', and 'Disponent' were highly susceptible to the Danish population of mildew on wheat, demonstrated by virulence frequencies near 100. The most resistant varieties on the 1985 national list of varieties were Longbow, Bert and Kosack according to the investigations.

Examinations for the occurrence of barley yellow mosaic virus and Rhizomania virus and their respective vectors *Polymyxa graminis* and *P. betae* (Lillian Kloster)

In 1985 there were no reports of symptoms of attacks of barley yellow mosaic or Rhizomania in Denmark, but the diseases are spreading quickly in our neighbouring countries to the south.

By means of direct microscopy of winter barley and spring barley collected in June - October, 3 out of 22 samples of winter barley and in 1 out of 7 samples of spring barley were found to contain *P. graminis*.

In the autumn of 1985, soil samples were collected from 86 fields where winter barley had been grown as preceding crop within the last 3 years (37 of them placed in Southern Jutland) and used for a glasshouse test, where the soil samples were sown with susceptible 'Igri' winter barley and grown for 3 months.
The roots of the plants were examined microscopically for the occurrence of the vector *Polymyxa graminis*, which was found in 63% of the samples. 'Triumph'

spring barley was sown in 7 of the soil samples. *P. graminis* was not found in any of these roots. No difference was demontrated in attacks on roots from grains that had been seed treated and roots from untreated grains.

Sugar beet plants collected in 113 fields in the southern part of the country were tested for Rhizomania virus by the ISEM and leaf test methods. Virus was not found. The vector *P. betae* was not found in any of the samples, but the roots were so poorly preserved, that the determination must be considered uncertain.

Virus was not found in beet plants grown in soil samples from the same fields under glasshouse conditions. Beet roots from 3/4 of the glasshouse samples were examined microscopically for the presence of the vector *P. betae*. *P. betae* was found in 76% of the samples. Seed treated as well as untreated seeds were attacked by *P. betae*.

Fungal diseases in rape (Lone Buchwaldt)

Warnings against attacks by stem rot (*Sclerotinia sclerotiorum*) in winter and spring rape were given in cooperation with the agricultural advisory service.

In 1985, 12 advisers reported of apothecial sprouting from sclerotia in deposits established up and down the country. These reports were supplemented with our own observations, spore counts and climatic data.

In 1985 an examination of approx. 100 rape seed samples was started to establish the occurrence of sclerotia from stem rot. 61% contained sclerotia, of these 7% exceeded the limit of 10 sclerotia per 100 g of seeds. The occurrence will be related to the severity of attacks in fields and growing conditions.

The hampering effect of pelleted calcium cyanamide on the sprouting of sclerotia of the stem rot was demonstrated in a field experiment with artificial infection carried out in small plots.

Wart disease (*Synchytrium endobioticum*) (H. Mygind)

The annual testing of new potato clones for resistance against wart disease was carried out in January - March. 349 number varieties were sent from the potato breeding station at Vandel. Of the total number of samples 284 were tested the 1st year, 40 samples went through the test of the 2nd year, and 25 samples were tested for the third and last time.

Diseases in sour cherry (Karen Jørgensen)

A project initiated by the Joint Committee for Agricultural Research and

Experiments has made it possible in cooperation with the Institute of Pomology to investigate why buds and trees in sour cherry die.

In the orchards visited, one or several of the following pathogens were found: Prunus necrotic ringspot virus, bacterial canker (*Pseudomonas syringae pv. morsprunorum*), blossom wilt (*Monilinia laxa*), and cherry leaf spot disease (*Blumeriella jaapii*).

The life cycle of bacterial canker under Danish climatic conditions was studied by means of inoculation experiments, and the susceptibility of different sour cherry varieties to bacterial canker was investigated.

A method for quick and reliable diagnosis of prunus necrotic ringspot virus was developed in cooperation with the Virology Department.

Cherry leaf spot disease: Examinations have shown that in Denmark the fungus overwinters in the apothecial state, and that the primary inoculum consists partly of ascospores and partly of apothecial conidia.

Downy mildew (*Bremia lactucae*) (H.A. Jørgensen)

Experiments to test the resistance of butterhead lettuce and iceberg lettuce to downy mildew were carried out in cooperation with lettuce growers under the Danish Association of Horticultural Producers partly to find suitable cultivars, partly to register physiological races occurring in Denmark.

New attacks (H.A. Jørgensen)

Cryptodiaporthe castanea (Tul.) Wehm. in *Castanea sativa*
Fusarium oxysporum f.sp. *opuntiarum* in *Rhipsalidopsis* sp.
Phomopsis brachyceras Grove in *Ligustrum vulgare*
Rhizosphaera kalkhoffii Bub. in *Abies nobilis*
Gloeosporium cyclaminis Sib. in *Cyclamen persicum*
Pestalotia microspora Speg. in *Ananas comosus*

Diagnostic work (Karen Jørgensen, H.A. Jørgensen and H. Mygind)

In 1985 the Botany Department made diagnoses of bacterial and fungal diseases of approximately 550 plant samples, mostly horticultural, sent to the department.

IV. VIROLOGY DEPARTMENT, H. Rønde Kristensen

1. Experimental work

At the Virology Department the employment of Morten Heide has brought about an appreciable and long-felt desire for expansion of the diagnostic field of activity. On one hand, the serological work has been continued and new methods within this field are applied, on the other hand biochemical methods have been included in the diagnostic examinations.

At the same time, the laboratory facilities and the equipment at the Virology Department have been improved first and foremost with a new and highly advanced ultracentrifuge, a high speed centrifuge and various equipment for electrophoresis, etc.

Examinations concerning virus diseases in agricultural plants have focused on virus diseases in potatoes - especially rattle virus and other diseases resembling rattle virus. As was the case in previous years a considerable amount of work has been done in connection with the potato meristem programme.

Besides, comprehensive examinations of soil and plant samples from beet roots and winter barley fields have been carried out in order to find Rhizomania and barley yellow mosaic virus.

In 1985 a considerable amount of work has been done to produce healthy nuclear material, free from virus attacks, of both ligneous and herbaceous horticultural plants. The methods used are thermotherapy and/or tissue culture.

In connection with the tissue culture, examinations are carried out to establish the most suitable growth media for the individual plant species. Besides, temperature experiments were carried out with meristem plants in the rooting phase and preservation experiments with meristem cultures in test tubes.

In 1985, the scientific staff made 21 trips to 10 other countries.

54 guests from 25 countries visited the Virology Department.

The scientific staff gave 45 lectures.

Virus diseases in agricultural plants (Bent Engsbro)

Cocksfoot mottle virus

In cocksfoot differences are known between susceptibility of varieties to the

cocksfoot mottle virus. Cocksfoot mottle virus is transmitted by leaf beetles and perhaps mechanically.

In greenhouse experiments carried out in 1985, 10 plants of each of 25 varieties were mechanically inoculated with an isolate of cocksfoot mottle virus collected near the town Ringkøbing in Jutland.

The appearance of symptoms started 10 days after the inoculation.

An assessment made 3 months after the inoculation showed that the varieties could be devided as follows:

2 varieties without symptoms
2 varieties with weak mottle
7 varieties with distinct mottle on weak plants
14 varieties with severe mottle, weakened and withering plants

After 6 months, the last 3 in an unheated greenhouse, many of the plants of the most susceptible varieties had died.

This experiment shows differences in the susceptibility also among the varieties used in Denmark, and this should be taken into consideration in the variety evaluations.

Partial infection by potato virus Y (PVY)^{O}

An examination of 2 healthy potato lots of the cultivar 'Bintje', subjected to infection, showed that 334 and 70 plants respectively were infected by PVY^{O}.

In both lots 13% of the infected plants were totally infected, whereas the rest, 87%, were only partially infected.

An examination of all the 557 tubers from the 70 plants showed that only 3 were partially infected, whereas the rest, 99,5%, were totally infected.

Thus, partial infection is the common type of infection in the plant, and total infection is the common type of infection in the individual tuber.

Shortening of stems of potatoes grown in greenhouses

The use of Alar 85 for shortening the stems of potatoes grown in greenhouses in 1984 led to the shortening wanted, but did, at the same time, reduce yields considerably.
In the harvested tubers, planted outdoors in 1985, no effect from the compound

could be seen with regard to germination and growth.

Necroses in potato tubers

In several localities in Western Jutland, comprehensive attacks by internal necrotic rust were found in the tuber of the cultivar 'Saturna'.

Comprehensive attacks make the tubers unsuitable for consumption (production of chips).

The symptoms are similar to those caused by rattle virus and mop-top virus, but in the preliminary examinations it has not been possible to demonstrate these 2 viruses.

Soil samples from the areas mentioned contained only few stubby-root nematodes of the genera *Trichodorus* and *Paratrichodorus*, which are vectors for rattle virus.

A weak clearing of the fine leaf nerves appears in the bait plants (*Nicotinia tabacum* var. 'Samsun') and 2 to 3 weeks after inoculation in the test plants (*N.t.* var. 'Samsun', 'Xanthii', and 'Clevelandii') inoculated partly from bait plant roots, partly from necrotic tuber tissue, and the leaves become a little paler and turn yellow. The infection is systemic, but, apparently, does not affect growth.

2 to 3 weeks after the inoculation of the test plant *Chenopodium quinoa* local, sunken, irregularly shaped injuries appear. Later some necrotize and others turn red.

There were no symptoms of rattle virus, mop-top virus or tobacco necrosis virus.

An examination of bait plant roots showed many chlamydospores and some mycelium of a *Cylindrocarpon* species. Besides, there were some *Fusarium* and some of an imperfect fungus.

Rod-shaped particles were not found in electron microscopic examinations of leaf material both from bait plants and test plants and of pestled tuber tissue showing rust symptoms.

The above mentioned examinations do not give indication of attacks by the viruses so far known to cause necroses in potato tubers.

Virus diseases in fruit trees (Arne Thomsen)

Dappled fruits - virus in apple trees

In an experiment testing cultivar susceptibility to Dapple apple, 20 apple cultivars were, in 1980, inoculated with infected material. 3 cultivars: 'Cortland', 'James Grieve', and 'McIntosh' developed dappled fruits and greenish yellow leaf mottle in 1985.

In the rest of the 17 cultivars, among others in 'Ingrid Marie' and 'Summerred', no fruit or leaf symptoms have so far been found.

Apple rootstock meristem-tip culture

Soggied growth which often occur in meristem cultures of the apple rootstock M 26, can be changed to normal growth by the use of a weak nutrient medium and high intensity of light in the growing room (more than 3000 lux).

Virus diseases in fruit bushes (Arne Thomsen)

Stunt in raspberry

In the cultivar 'Veten' from an old plantation on Sealand few plants were found in 1985 which showed attacks by Rubus stunt. The pathogen which causes the attack by stunt consists of organisms resembling mycoplasma (MLO).

Virus diseases in vegetables (Niels Paludan)

Inactivation of tobacco mosaic virus (TMV) in sap

Introductory experiments with the tobacco strain of TMV showed that the aldehyde derivative 'Korsolin' had no inactivating effect when applied with a strength of from 0.05 to 16% and for a period of from 1 to 72 hours.

However, promising results were obtained with trisodiumphosphate in 1%. Applied in combination with the surfactant 'Teepol 610' also in 1% and with a period of treatment of 1 hour the effect was furthermore increased.

The same combination has inactivated the TMV-strains tobacco, pepper-8, and MGD in all dilutions of the infected sap (from 1:20 to 1:2 million). With regard to the tomato strain, however, that goes for dilutions > 1:200 only, but the virus was considerably weakened in dilutions below that ratio. In the undiluted sap, the TMV, regardless of strain, was neither hampered nor inactivated.

Heat tolerant strains of cucumber mosaic virus

Different virus strains were examined for heat tolerance and the possibility of serological test (ISEM). A 'Damascus' strain and strain D (serotype Song received from Lecoq) were the only ones to develop leaf symptoms at 30°C. The rest of the virus strains comprised 4 from Denmark and 2 from Great Britain.

Except for strain D the virus strains could be demonstrated by means of an antiserum (Danish product) in plants grown at 20°C, but not at 30°C.

Virus strains of TMV

A Danish isolate of TMV from *Aeschynanthus* and a MDG strain received from Wetter did not attack tomatoes, but showed different effects on the pepper variety 'Pekana'.

The TMV strain tomato, tobacco, pepper-8 (Rast) and MDG all produced serious fruit symptoms in 'Pekana' in all the harvested fruits.

Inactivation of TMV in pepper seed

Newly harvested pepper seeds from plants infected with TMV-pepper-8 strain were used for inactivation experiments. The seed was dry when harvested.

Absolute inactivation was obtained with trisodiumphosphate 10% applied for 2 hours and with trisodiumphosphate in combination with the surfactant Lissapol plus in 1%. The latter treatment produced the highest germination percentage.

Virus diseases in ornamental plants (N. Paludan and A. Thomsen)

Pelargonium zonale. A diagnosis was carried out of 15 pelargonium plants collected that showed different virus symptoms, using the ISEM method at the four seasons of the year. The varieties comprised, 'Amanda', 'Springtime Irene', 'Tressure Chest', and 'Vesuv'.

Antiserum was applied against the following 5 virus:

Pelargonium leaf curl virus (PLCV), pelargonium flower break virus (PFBV), pelargonium line pattern virus (PLPV), pelargonium ring pattern virus (PRPV), and tomato ringspot virus (TomRV).

PLCV was not found. The other viruses occurred in 50 to 75% of the plants.

The number of viruses found in the individual plants was: 1 viruses in 3 plants, 2 viruses in 2, 3 viruses in 9, and 4 viruses in 1 plant.

The symptom development in the variety 'Springtime Irene' shows absolute accordance with the virus found. PFBV alone causes serious symptoms both in leaves (mosaic and vein bands) and in flowers (break) all the year round. In combination with TomRV yellow rings develop in spring. PLPV and PRPV are latent viruses and do not change the symptom development, also not in combination with other viruses.

PFBV does not cause flower break in the other varieties, and these varieties show fewer leaf symptoms when attacked by the different viruses than 'Springtime Irene'.

Seasonal variations as to diagnosing the 4 viruses with 38 possible reactions show an average percentage of findings in February of 68, June of 58, August of 90, and November of 40.

The sensitivity of the ISEM method has proved optimal in the cases of PFBV and TomRV based on 11 testings of 6 plants. The findings of PLPV varied, however.

New varieties collected in the Netherlands, Norway, Sweden, and Germany comprised *P. zonale* and *P. peltatum*. In symptom free plants of the latter, PSBV was found. The virus and bacteria free collection of varieties now comprises 10 *P. zonale* and 8 *P. peltatum*.

The first preliminary results from the COST-87 project, an average from 5 countries, show that there are no problems with contamination, survival of ex-plants or the production of callus.

The production of shoots, however, has been low and only few ex-plants produce shoots.

Of established *P. zonale* plants 4% were free from TomRV and 43% were free from PFBV. The rate of mutation was 18% in the 1st subculture and 22% in the 2nd.

Begonia elatior

Meristem plants are established from plants infected with the bacterium *Xanthomonas begoniae* in order to investigate the possibility of producing plants that are free from bacteria. Both stock plants and meristem plants were tested by the use of KPA-agar and the immunofluorescence method. All of the 142 established meristem plants proved to be free from bacteria.

The production of begonia varieties free from virus and bacteria comprises 36 varieties with or without previous selection. Meristem plants are established and

propagated by means of cuttings taken exclusively from shoots of the axil in order to maintain genetic stability.

The plants are tested for bacteria twice and the virus symptoms are registered during 1 year. The first 18 varieties have been tested and delivered.

Experiments have shown, that the formation of adventive shoots depends on the concentration of the nutrient medium and the use of growth substances. The lower concentration, the fewer shoots.

Euphorbia pulcherrima

Normal shoot growth was established by means of meristem culture. Root formation, however, was not obtained despite repeated experiments with different media, growth media combinations and sugar content.

The meristem plants were tested for poinsettia mosaic virus (PMV) and poinsettia cryptic virus (PCV) by the ISEM method. Out of a total of 90 plants 71% were free from PMV and 56% were free from PCV.

Kalanchoë blossfeldiana

Virus free seed plants of *K. daigremontiana* were established for testing purposes. Shoots were top grafted on *Kalanchoë* infected with K. latent virus (KLV) and on meristem plants from *Kalanchoë* with severe mosaic.

The seed plants reacted with weak vein clearing and vein spots to KLV and with strong chlorotic vein bands and vein spots to mosaic, which proves that the meristem plants were not free from mosaic.

Arabis caucasica

Selected clones have proved to be infected with tomato blackring virus and with a hitherto unknown virus respectively. As this plant material has attracted much attention, f.inst. for pot plants, an attempt was made to clean the clones by means of meristem culture and heat treatment.

Plants free from tomato blackring virus were not obtained until after 2 months' heat treatment at 34^{o}C before the meristem cutting took place.

Virus diseases in ornamentals (Niels Paludan and Arne Thomsen)

Lewisia spp., meristem-tip culture

When grown in a MS-medium with macro nutrient media at half strength, plants with roots have been established of *Lewisia* spp.

Ligustum vulgare, arabis mosaic virus (AMV)

In 1985 arabis mosaic virus was found in nursery plants of *Ligustrum vulgare*. The infected plants showed no leaf symptoms, but the growth was obviously affected.

Narcissus spp., breeding control

In spring, attacks by arabis mosaic virus and rattle virus in combination with poor growth were found in many samples of potted narcissus plants with narcissus mosaic virus. The worst injuries occurred in the narcissus variety 'Tete a tete'.

Miscanthus sinensis, meristem-tip culture

Meristem cultures from rhizomes of *Miscanthus sinensis* 'Giganteus' were established in 1984 as individual plants in vitro. By using high concentrations of cytokinin, 25 - 50 ppm per litre, it was possible to produce 10 - 15 plants per unit. The growth medium 2-4 D apparently is necessary for the growth of *Miscanthus* in vitro.

Syringa, meristem-tip culture

Meristem-tip cultures used to be established from virus infected *Syringa vulgaris.*

In order to obtain optimal multiplication in vitro it has been necessary to carry out the reproduction by leaf cuttings.

Propagation

In 1985 the following species and varieties of ligneous ornamentals were examined and found free from virus:

Cytisus scoparius
Diervilla spp,
Lugistrum obtusifolium var. *regelianum*
Ligustrum vulgare
Malus sieboldii
Prunus laurocerasus Colchica
Prunus laurocerasus Compacta

Prunus laurocerasus Mischeana
Prunus laurocerasus Rotundifolia
Prunus laurocerasus Zabeliana
Rosa dumalis

Electron microscopy (J. Begtrup)

In 1985 approximately 3,900 EM analyses were carried out (ISEM technique).

Embeddings, carried out with the cutting technique, have been performed to a limited extent (in sprouted Cuscuta seeds) in cooperation with the Danish State Seed Testing Station .

In connection with the registration of the fungus-borne virus, barley yellow mosaic and Rhizomania, 700 examinations were carried out; up till now the diseases mentioned have not been found in Denmark.

Electron microscopical examinations were also carried out in connection with the EEC research project, COST-87, and approximately 1200 pelargonium samples were examined for tomato ringspot virus and pelargonium flower break virus.

As was the case in previous years a very large number of electron microscopical examinations were carried out in connection with the comprehensive tissue culture programmes for potatoes and horticultural plants.

Biochemical methods of diagnosing (Morten Heide)

The primary aim of the laboratory is the development of rational methods of diagnosing plantpathogenic viruses and bacteria. The work mainly comprises 2 areas: electrophoresis and methods based on immunology.

Electrophoresis

Potato spindle tuber viroid (PSTV)

The aim has been to develop and incorporate a routine method for testing potato spindle tuber viroid. The work has involved finding a suitable method of extraction from plant tissue and a suitable method of electrophoresis.

The most suitable extraction method proved to be phenol extraction followed by lithium chloride precipitation and ethanol precipitation.

The most expedient electrophoretic method proved to be polyacrylamide electrophoresis (8%) followed by dying with toluidine blue.

Thus PSTV was detected in 0.5 g green tissue from potatoes. The method is now used routinely with a capacity of approximately 20 samples per day.

It is also the intention to use this method for indexing the occurrence of viroid in other plants, e.g. *Chrysanthemum*.

In future, two-way electrophoresis combined with silver staining will be tried with a view to increasing the sensitivity of the test.

Isolate differentation

SDS-polyacrylamide-electrophoresis combined with silver staining was tried for qualitative examinations of bacterial and fungal isolates. Preliminary results with various isolates of the fungus *Septoria tritici* indicated that the method is suitable for this purpose.

Immunological methods

ELISA and Dot Immuno Binding (DIB)

The aim is to incorporate routine detections of a wide spectrum of virus from green parts by means of ELISA. In 1985 routine findings of tomato ringspot virus in *Nicotiana* and *Begonia* were incorporated.

DIB proved to be very useful for detecting virus in seeds. DIB resembles ELISA in principle, but is simpler to carry out and requires fewer immunological reactors. In cooperation with the Danish Government Institute of Seed Pathology for Developing Countries a standard method was developed for detecting barley stripe mosaic virus in barley and bean common mosaic virus in beans by means of DIB.

Serum bank

In 1985, the stock of sera of the institute was computerized. The serum was registered according to type of virus, virus isolate, year of production, method of production (method of purification and reproduction plant), type of storage, animals used for experiments, titer, application, and quantity.

The registration comprises more than 450 different items distributed on 116 different virus. Sera from the Danish Government Institute of Seed Pathology for Developing Countries and from the Institute for Plant Pathology at the Royal Veterinary and Agricultural University were also included in the registration.

Antisera and immunological reactors

No new antisera were produced in 1985. The quality of a number of previously

produced antisera was improved by means of cross fixation.

In 1985 antisera and immunological reactors were delivered to a number of institutions in Denmark and the rest of the world.

New attacks (Bent Engsbro, Niels Paludan, Arne Thomsen)

Aeschynanthus hildebrandii	Carnation mottle virus
Agapanthus praecox	long flexible particles
Cytisus sp.	raspberry ringspot virus
Delphinium sp.	cucumber mosaic virus (1972)
Dipladenia hybr. rosea	750 nm particles
Helenium sp.	30 nm particles (1976)
	5-600 nm particles (1973)
	720 nm particles (1976)
Kalanchoë sp. ('Madeira')	kalanchoë latent virus strain 2
Ligustrum vulgare	arabis mosaic virus
Solanum tuberosum	spherical virus
Tamarix sp.	raspberry ringspot virus

V. ZOOLOGY DEPARTMENT, J. Jakobsen

Potato cyst nematodes (*Globodera rostochiensis, G. pallida*)
(J. Jakobsen og L. Monrad Hansen)

Examinations of soil samples to detect potato cyst nematodes were carried out for the Government Plant Protection Service and the the National Committee for the Propagation of Potatoes.

The number of samples examined and the number of samples in which potato cyst nematodes were found were as follows:

	Number of samples	Number of samples with potato cyst nematodes
Areas with seed potatoes	5.650	65
Special examinations	672	59
Nurseries	569	7
Growers	392	17
Export	327	6
Localities with potato cyst nematodes	247	83
The National Committee	550	-

For the potato breeding station at Vandel potato crosses were examined for resistance to pathotype Ro-1, PA-2, and PA-3. Examinations of resistance to PA-2 and PA-3 were based on Dutch populations, which have been propagated in isolated greenhouses since 1978.

Despite the current discussion as to differences or lack of differences between the various pathotypes of potato cyst nematodes distinct differences were registered between the PA-2 -PA-3-populations in relation to the tested potato crosses.

Cereal cyst nematodes (*Heterodera avenae*)

Soil samples from 70 barley fields were examined in 1985.

The content of cereal cyst nematodes were distributed as follows:

Number of eggs per kg soil	Number of fields	Per cent
0	26	38
<1.000	18	26
1.000-5.000	13	19
5.000-10.000	5	7
10.000-20.000	5	7
>20.000	2	3

Beet cyst nematodes (*Heterodera schachtii*) (Lars Monrad Hansen)

Based on presumption among beet advisers and others that beet cyst nematode problems is an increasing problem, approximately 700 beet growers were asked to send in soil samples from areas, which were suspected to be infested with the beet cyst nematode. Only 50 beet growers reacted to the request, and of these, 36 too random samples. The occurrence of eggs and larvae were:

Number of eggs per kg soil	Number of fields	Per cent
0	18	14
<1.000	12	33
1.000-5.000	5	14
5.000-10.000	1	3
>10.000	0	0

Stem nematode (*Ditylenchus dipsaci*) (J. Jakobsen)

In cooperation with the National Pesticide Research Institute an experiment was carried out with control of stem nematodes in Bulb onions by means of oxamyl (Vydate L).

The experiment was carried out in a field, which had been severely infested by stem nematodes in onions in 1984.

Of the dosages used - 0.5, 1.0, 2.0, and 3.0 ml oxamyl per m row watered down after germination - the two highest dosages were able to prevent attacks in onions. The two lowest dosages reduced attacks considerably compared to untreated areas, but were not able to prevent attacks completely. Onions from the treated plots were examined 6 times, and the last examination took place 6 months after treatment.

Hirsutella heteroderae - a fungus which occurs as a parasite on cyst nematodes (M. Juhl*).

An experiment in which spores of *H. heteroderae* were added to soil infested by beet cyst nematodes showed that this fungal species can reduce the number of recently formed beet cyst nematodes with up to 90% compared to untreated soil.

The experiment was carried out as pot trials in a greenhouse, using (A) soil with and (b) soil without beet cyst nematodes. The infested soil contained approximately 100 eggs per g soil. In the soil which was not infested, 6000 hatched larvae were added to each pot. Approximately 7×10^8 spores of H. heteroderae were added to each litre of soil. The greatest reduction of recently formed cysts was obtained in soil A.

*: Died in December 1985

The influence of cereal cyst nematode (*Heterodera avenae*) on growth and development of spring wheat (Werner Riedel)

Spring wheat is one of the best host plants for cereal cyst nematodes, and it can be seriously injured by severe attacks.

Why attacks by cereal cyst nematodes inhibits the growth of their host plant has not been fully described. Poor rooting and a consequent reduction in ability to absorb water and nutritive salts is the common explanation.

As part of the final thesis in connection with his biology studies at the University of Copenhagen, Werner Riedel examines the differences in development of spring wheat plants infested by cereal cyst nematodes and uninfested plants. The examinations are carried out as field and greenhouse experiments and will be finished in 1986.

Registration of aphids in potato fields in Jutland (J. Reitzel).

Aphids were caught in 15 fields in Jutland from late June to the beginning of August. The catches were carried out by means of yellow tray traps, which were emptied twice a week.

The aim of this registration is to determine, when there is a risk of transmission of aphid-borne viruses in potatoes for propagation and thereby to decide the best time for a haulm destruction.

The examinations were carried out for the Government Plant Protection Service and paid for by the grosers Association.

The occurrence of aphids and therefore the risk of infestation was moderate in 1985.

Registration of aphids and mildew in spring barley (L. Monrad Hansen).

The computer-based system to register and warn against aphids and fungal diseases, which has been developed by the Zoology and Botany departments, was continued in 1985. Approximately 400 growers participated by sending in information, starting at the end of May, on the occurrence of aphids and mildew in their spring barley fields. On the basis of the current registrations as well as on information about cultivars, soil treatment and meteorological observations recommendations were sent to the growers for treatment, if necessary, against one or more pests or diseases.

The reports sent in from the growers were also used for issuing plant protection bulletins in which the severity of attacks by the various pests and diseases in different parts of the country were described.

The general evaluation of the system is that standardized methods for determining the severity of attacks by the individual pests and diseases together with the recommendations sent out to growers, provide them with a valuable support in their decisions on whether to control or not.

Registration of pea moth (*Cydia nigricana*) in fodder peas by means of pheromone traps (F. Lind)

The pea moth may be a serious pest in peas, but often the attacks occur locally. The pheromone trap is an appropriate tool for the determination of the migration of pea moths.

The growing of fodder peas is increasing, and this caused a chemical firm to send out pheromone traps to about 270 growers. Each grower received 2 traps, which were placed about 100 m apart. The catch of pea moths was counted twice a week from the beginning of June to the beginning of August.

The occurrence of pea moth was generally moderate in 1985. Flight activity was most intense at the beginning of July, but with significant regional differences. Therefore, there is a need for determining through the flight activity - the risk of attacks involving losses, locally and possibly in the individual fields.

Registration of aphids in experimental plots (F. Lind)

A registration of the aphid population density in experimental plots with sping barley and winter wheat was carried out in cooperation with the National Pesticide Research Institute.

The significance of late aphid attacks in spring barley (J. Jakobsen)

There is some uncertainty as to the significance of aphid attacks in spring barley after the earing up has taken place. Therefore a semi-field experiment was carried out, in which aphids were placed on spring barley grown in units covered by nets. The experiment comprised the spring barley cultivars 'Cerise', 'Ida', 'Triumph', and 'Golf'. At stage 9.5 aphids were added, approximately 25 to each unit, which contained 3 barley plants. The propagation of aphids was registered 4 times, until the cereal got ripe.

The yields were significantly lower for all cultivars infested with aphids compared to not infested plants. On an average the grain yield from plants infested with aphids in the beginning of August - stage 11 - was half that of non-infested plants.

Methods of estimating the densities of soil-living beetles (Jane Brenøe)

The natural enemies of the pests, especially the beetles, may be of importance for the development of infestations involving losses. Therefore, there is a need for simple methods to determine the density of such species. - This is a condition for a development of monitoring programmes, which over a number of years can detect possible long-term effects on this part of the fauna. Moreover, such methods are necessary if consideration of the beneficials are to form an important part of Integrated Pest Management programmes. As a basis for the final thesis in connection with her biology studies at the University of Copenhagen, Jane Brenøe examined the possibilities of making "local catches" of beetles by extracting the beetles from soil by means of water and formaldehyde in an area limited by a circular metal frame driven down into the soil and inclosing an area of 0.125 m .

The extraction of beetles within the limits of the metal frame by means of 2.5 l of water seemed to be satisfactory. No difference was registered with regard to the number of beetles extracted by water and by a 0.15 formaldehyde solution.

Examination of the biology of the pea and bean weevil (*Sitona bilineata*) (Jan Westh and Carsten Strøm)

As a part of their final thesis in connection with their biology studies at the University of Copenhagen, they study the activity pattern of the pea and bean weevil, and the damages which the occurrence of pea and bean weevils may cause in fodder peas.

Furthermore, different catch methods are examined with a view to the development of registration tools, making it possible by means of density estimates to determine the injury threshold for pea and bean weevils in fodder peas.

The examination will be finished in 1986.

The use of pheromone traps for estimating the flight activity of turnip moths (*Agrotis segetum*) (P. Esbjerg)

Pheromone traps using synthetic pheromones is now a routine in connection with forecasts of turnip moth attacks. For a number of years Peter Esbjerg has carried out detailed examinations of the reactions of turnip moths to pheromone traps under different weather conditions. These examinations have provided a background for individual growers and grower-organizations to set up traps at many localities, in areas where crops particularly susceptible to cutworm attacks are concentrated. There is now a reasonably extensive coverage by pheromone traps.

The influence of the weather conditions on the propagation of cutworms (*Agrotis segetum*) (P. Esbjerg)

Attacks by cutworms vary considerably both locally and from one year to another.

Previous experiments have shown that precipitations in the period when the larvae are small are decisive for larvae survival.

Investigations of the importance of soil moisture for the survival were carried out in bucket experiments in an area which was covered with plastic and therefore not exposed to natural precipitation.

The mortality among larvae at different stages of development and different degrees of soil moisture was investigated, and confirm previous results concerning the significance of soil moisture to the survival of small larvae.

The influence of temperature and food on the growing conditions of cutworms (*Agrotis segetum*) (Peter Esbjerg)

It is important to know the influence of temperature on growing conditions in order to calculate the optimum time for control with a view to warnings against cutworm attacks. Both temperature and food quality influence the population development.

Mortality, time of development of different stages and weight of the pupae were found for groups reared at a number of different temperatures. The variations of the same parametres were examined under the influence by the type of food, i.e. carrots, potatoes, onions, leeks, and an artificial substratum.

Yellow sticky trap trays as warning tools against carrot flies (*Psila rosae*) (Peter Esbjerg)

Yellow sticky traps were set up at a number of carrot-growing localities. The registrations of catches were sent in by the advisers and growers, and warnings based on this information were sent out.

In connection with harvest, injuries were assessed for each locality. Untreated plots made it possible to assess the extent of the injuries in relation to the effect of control.

Pheromone traps for estimating the migration of the codling moth (*Cydia pomonella*) (Søren Laursen og Peter Esbjerg)

Pheromone traps were set up in a number of commercial apple orchards on Sealand and Funen in cooperation with the company Hoechst and the Danish Association of Fruit Growers. Catches of codling moths were reported to the Research Centre for Plant Protection by the participating growers, and warnings were sent out on the basis of these catch results.

Investigations of the egg-laying behaviour of the codling moth and the development of the larvae of the codling moth (Søren Lauersen)

As part of his study of horticulture at the Royal Veterinary and Agricultural University, Søren Laursen systematically examined a large number of apples during the growing season in order to follow the egg-laying of the codling moth and the development of its larvae.

Biological control of thrips (*Thrips* spp.) by means of predatory mites (*Amblyseius* spp.) L. Stengård Hansen

A mass rearing of predatory mites continued. The predatory mites are reared on flour mites, which feed on bran mixed with dry yeast. Decisive for an optimum rearing of flour mites is (1) that the bran is heat treated, so that any predatory mites are killed, (2) that the atmospheric humidity of the bran is high.

Different production systems have been tested, and now the production takes place in a room with a high atmospheric humidity, where the mites are reared in sealed paper bags.

The stock populations of predatory mites and flour mites are reared in different buildings in order to avoid unintentional mixing.

In greenhouses where predatory mites have been introduced, estimates have been made of the densities of thrips and predatory mites.

Satisfactory results were achieved in 6 greenhouses where a total of 300 - 600 predatory mites were introduced per m^2, distributed on 3 - 5 occasions.

Biological control of pests in pot plants (J. Reitzel)

Several experiments have been made with control of white flies, the two spotted spider mites and thrips in pot plant cultures in market gardens. Generally, the control of the individual pests has been satisfactory, but the experiments were interrupted either because other pests occurred, or because the infestation was too severe to be controlled biologically compared to what could be achieved by means of chemical control. Crucial for the use of biological control of pests in greenhouse-cultures of pot plants is cheap methods of carrying out a mass rearing of beneficials. This allows frequent introductions of many beneficials against different pests.

Attacks by a species of thrips (*Franklinella occidentalis*) which is difficult to control chemically (J. Reitzel)

Attacks by thrips in Saintpaulia have resulted in considerable losses for several growers, as it was impossible to control this species of thrips effectively by means of chemicals.

A number of different insecticides have been tested in cooperation with the National Pesticide Research Institute. The product Baytroid had the best effect, but the result was unsatisfactory.

There are reports of similar problems from German and Dutch greenhouses.

Testing of products against strawberry tarsonemid mites (J. Reitzel)

Attacks by mites in strawberries may result in considerable damages, and at the same time they are difficult to control.

Control experiments were carried out in cooperation with the National Pesticide Research Institute in a strawberry field on Sealand.

The effect of the control was assessed by counting the mites and their eggs on twenty plants before and after treatment.

Rearing of the carabid (*Bembidion lampros*) and development of standard methods for determining the effect of pesticides on this species (L. Samsøe-Petersen)

Bembidion lampros occurs in great numbers in cultivated areas and is important as an aphid predator.

Therefore this species was selected as test animal among the collection of indicator species, which the Zoology department wishes to have at its disposal with a view to the development of standard methods for determining the effect of pesticides on the beneficial arthropods.

It is not possible, however, to carry out a continuous mass rearing under laboratory conditions.

Therefore the development of rearing methods constitutes the first phase of this project.

On the basis of mass catches of beetles from fields, the animals are subjected to different temperature and light conditions in the laboratory where they are fed on different types of food such as eggs of flies and dog biscuits.

It was possible to get the beetles to lay eggs all the year round, and a satisfactory amount of the eggs hatched. The larvae can develop into adult beetles when they are kept apart. Egg-laying and larvae development seem to be influenced by the food to which the animals have access.

Test method for determining the effect of pesticides on the rove beetle *Aleochara bilineata* (L. Samsøe-Petersen)

Rearing methods and a laboratory test for determining the effect of pesticides on *Aleochara bilineata* have been developed.

The test method is one of the standard methods which are coordinated by a working group under the IOBC.

The influence of pesticide exclusion strips on the beetle fauna in spring barley (L. Samsøe-Petersen)

As part of a three-year project organized and financed by the Centre for Terrestrial Ecology, beetle species have been collected and identified in a spring barley field at the estate of Gjorslev on the island of Sealand.

The aim of the experiment is to determine the importance of not applying pesticides on the headlands of the fields - particularly where the field is bordered by hedges.

Catch samples are taken from May to October by means of pitfall traps.

The species are collected both in treated and in untreated headlands, as well as in the parts of the field that have been treated in the usual fashion. In addition,

a registration of aphids and mildew is carried out.

Development of a method for determining the effect of pesticides on the parasitic wasp *Encarsia formosa* (Fibi Habtu)

The use of the parasitic wasp *E. formosa* in the control of white flies in greenhouses is widespread.

Therefore it is important to know the effect of pesticides which are used in the control of pests and diseases in combination with biological control of white flies. The investigation is made by Fibi Habtu in connection with the final thesis for her study of biology at the University of Copenhagen, which she expects to finished in 1986.

B. PESTICIDE RESEARCH CENTRE

I.GENERAL SURVEY by E. Nøddegaard.

Most of the resources of the Pesticide Research Institute are applied within the main fields: Testing and approval, evaluation of effectiveness of new and reevaluation of old products. Furthermore the following 3 projects were continued from 1984: Fungicide resistance of mildew in cereals. Investigation of resistance to ergosterol inhibiting fungicides of mildew in cereals. Reduced pesticide application in fruit trees and bushes by changing dosages and time of spraying.

The approval scheme

Testing and approval of products take place according to an agreement between the Ministry for Agriculture (Danish Research Service for Plant and Soil Science) and the Danish Agrochemical Association.

The companies pay for the testing according to fixed rules and rates. The rates are index-regulated by the 1st of January. For 1985 the rates have been increased by 6.6%. The regulation is based on the regulation index worked out by the National Bureau of Statistics from October quarter 1983 to October quarter 1984.

Since 1984 a registered standardization mark is used for approved pesticides and growth regulators. The companies may put this mark on the label of approved compounds next to the text of approval and they may also use it in advertisements, etc., if the text of approval is also stated. Furthermore the research institute uses the mark in publications where the approved compounds are mentioned.

Products with a satisfactory effect are entered into the list of "Pesticides and plant growth regulators approved by the Danish Research Service for Plant and Soil Science for control of plant diseases, pests and weeds, for withering of seed crops and potato haulm and for growth regulation".

The list of approved products is revised every year and published in January. In April a list of additions is issued. Only products registered by the Environmental Protection Agency for use according to the approval may be entered into the list.

The evaluation scheme

According to the provisions of Act No. 410 of 17th September, 1980, on chemical products, the Pesticide Research Institute must be consulted as to the efficacy of pesticides and growth regulators before the registration by the Environmental Protection Agency is carried out. The efficacy is estimated on the basis of test results sent in by the companies, experience and literature. If necessary, further tests and investigations may be carried out.

Old Products

According to an agreement of the 29th October, 1982, between the Environmental Protective Agency under the Ministry of the Environment and the Research Centre for Plant Protection, the Pesticide Research Institute shall assist the Environmental Protection Agency in the reevaluation of pesticides and growth regulators classified by the Toxicological Board.

On the basis of existing information, experience, test results and other documentation the Institute makes statements to the Agency concerning the importance and application of the products, possible alternative products and methods as well as economic consequences of limiting the fields of application of the products. Other institutions are consulted if necessary.

II. EXPERIMENTAL WORK

1. Agriculture

a. Fungal diseases (Bent J. Nielsen, Lise Nistrup Jørgensen)

Seed treatment products

Several new, liquid seed treatment products have been tested in wheat and rye with good effect against bunt. At the moment Neo-Voronit and Panoctine are the only liquid seed treatment products on the market. The effect of these products have been relatively weak in the experiments.

Neo-Voronit has shown poor efficiency in experiments carried out in later years, but with the new products, which have been tested, it seems possible to make new liquid seed treatment products providing good effect.

Experiments with leaf and glume blotch on wheat and *Fusarium* on winter barley were severely damaged during the winter period, and no attacks could be found.

In spring barley products containing imazalil are still the only products sufficiently effective against leaf stripe and net blotch. This year a new product has been tested (K 0708), and the results were promising.

It may be difficult to control loose smut by using chemicals, and only products containing triadimenol and metfuroxam have had good effect.

A new product (411 FN) seems to have a weak effect, whereas the other compounds tested had no effect at all.

Many of the systemic seed treatment products may, apart from their fungicidal effect, also have a negative effect on the germination processes of the kernel, thus reducing the rate and capacity of germination.

Most of the tested seed dressing products have had no effect on the capacity of germination of the cereal. Only few of the new formulations seem to have phytotoxic side effects.

Eyespot (*Pseudocercosporella herpotrichoides*)

Eyespot occurred in attacks of varying severity in the experiments, with an average of 35% in July (16 experiments).

Autumn treatment of eyespot

Two years' experiments with autumn treatment against eyespot show that autumn spraying with Sportak 45 EC and Derosal fl. in wheat has smaller effect on the disease than spraying in the spring, whereas the effect is almost the same in rye.

Autumn and spring treatment with Sportak 45 EC has given the same yield response in wheat, whereas the effect of treatment in the autumn was a little better in rye.

Autumn treatment with Derosal fl. has had no effect on the eyespot fungus nor did spring treatment.

Autumn spraying against eyespot is a preventive treatment, which should only be carried out, when there is a particularly great risk of attack by eyespot. Only in spring is it possible to determine the attack of eyespot and to forecast the need for spraying, which is in general the recommended procedure. It cannot be recommended to apply benzimidazol compounds in autumn.

Spring treatment of eyespot

Most of the experiments were made in fields where severe attacks were found in April. The experiments were sprayed in stage 5-6. In July the mean attack in the untreated experiments was 60%.

The effect of products which contain benzimidazol only (Benlate, Derosal fl. Topsin M, PLK Vondocarb) or a benzimidazol in combination with other active matters (Bayleton CM, Baydifan CM, Tilt CB) had in the experiments a very poor effect against eyespot, and the yield increase was only 1.5 hkg.

Products containing prochloraz (Sportak 45 EC, Sportak PF) reduced the attack of eyespot from 60 to approx. 27, which is equivalent to an average effect of 56%.

The yield increase with the prochloraz products was 6.3-7.3 hkg per ha. (mean increase 10%). A new product DPX N 7872. which, apart from the new product DPX H 6573 also contains carbendazim, had only little effect on eyespot (32% control), but gave a good yield increase of 5.8 hkg per ha. The product has good effect against several leaf fungi.

Mildew (*Erysiphe graminis*)

In wheat mildew was found in almost all the experiments, but the severity varied very much. The first attacks were found in the beginning of June (stage 8) and could be seen far into July, where the attack on an average reached 8.4% (19

experiments). This was only a moderate attack, but in susceptible cultivars (Kanzler) the attack reached 60%.

Treatment against mildew with two sprayings (stages 5-6 and 9-10.5) generally had good effect, and the effect of the products was in July 85% on an average (19 experiments).

In winter barley the first weak attacks of mildew were detected by mid May and developing drastically in the untreated plots. In some experiments the attack exceeded 70% by the end of June. On an average the attack in the untreated experiments reached 39.4% in the last half of June (13 experiments). After two sprayings (the stages 5-6 and 8-10.5.2) an average control of 82% was obtained in June, but with great differences between products. The spraying in 1984 was carried out too late due to the late start of the growing season, and the products were not sufficiently effective to control the established attacks.

In spring barley attacks of mildew started relatively late, and not until the end of June a development was seen in the susceptible cultivars. The attack was here 9.3% in the untreated plots (22 experiments) and reached in July 21% (21 experiments). The spraying was carried out on Feekes 5-8 and generally had good effect in June (87% control by the end of June (22 experiments)), but mildew was at that time of little importance to the yield.

In the experiments with cereals generally good effect was obtained against mildew with fenpropimorph, propiconazol and triadimefon. Tridemorph and diclobutrazol had good effect in barley, but smaller effect in wheat.

Leaf and glume blotch (*S. nodorum*) **and leaf blotch** (*S. tritici*)

In wheat both attacks of leaf and glume blotch and leaf blotch occurred, leaf and glume blotch being the dominating disease. Attacks were seen in approx. half the wheat experiments only and developed moderately. In July the attack in untreated plots reached 8.3% (13 experiments), and the two sprayings had an effect of 76%, with great variations between compounds. Good effect against *Septoria* was obtained with captafol, prochloraz, propiconazol and partly with chlorothalonil.

Net blotch on barley (*Drechslera teres*)

Generally weak attacks of net blotch were seen in winter barley, where the attack by the end of June was only 4.9% (15 experiments). After two sprayings a control of 71% was obtained. In spring barley attacks were very weak and occurred only in particularly susceptible varieties.

Scald (*Rhynchosporium secalis*)

In winter barley attacks of scald were slightly more severe than attacks of net

blotch, but the attacks never developed violently. By the end of June, attacks reached 8.6% (15 experiments). After two sprayings the control was 68%.

Rust (*Puccinia hordei, P. striiformis, P. recondita*)

Only scattered and weak attacks of rust (barley rust, yellow rust, brown rust) were seen.

Carbendazim resistance in eyespot (*Pseudocercosporella herpotrichoides*) (Bent J. Nielsen, Lise Nistrup Jørgensen, Hellfried Schulz)

On the basis of the decreasing effect of the benzimidazol compounds registered, experiments were made in 1984 on stubble samples to establish the distribution of the benzimidazol resistance of the eyespot fungus. The same methods were continued as those used in the experiments made in 1983. The fungus was isolated from samples of stubble sent to the institute and tested on 2 ppm benomyl. Samples from both untreated and carbendazim treated experimental plots were examined.

Resistant fungi were found in 55% of 47 wheat fields examined. In rye resistant fungi were found in 67% of 9 fields examined and in winter barley in 71% of 7 fields examined. Fields with more than 30% resistant isolates and consequently incurring a a potential risk of unsuccessful control, occurred with 23% in wheat, 56% in rye and 57% in winter barley.

Of a total of 477 examined wheat isolates 22% were resistant. Resistance was most widespread on Sealand, Lolland, Falster, Funen and in the South of Jutland.

The conclusion which may be made from the experimental material is that wheat grown as preceding crop during several years will increase the infection by eyespot from 17% the first year to 48% in the fourth year. At the same time control of eyespot with the use of carbendazim is reduced from 72% the first year to an effect of 27% the fourth year.

After one single treatment with carbendazim the occurrence of resistance has increased from 18% resistant isolates to 58% resistant isolates calculated as an average of 25 wheat experiments. The same tendency was found in rye and winter barley.

The experiments also showed a decreasing effect and consequently rising occurrence of resistant isolates in untreated experiments.

The effect was 70% when 0-20% resistant isolates were found, whereas the effect was only 7-18% when there were more than 20% resistant isolates.

The decreasing effect of the benzimidazol combinations and the extension of the resistance found have caused a withdrawal of the approval of these products in the control of eyespot as from 1986.

Investigation of the sensitivity of powdery mildew on barley (*Erysiphe graminis*) to ergosterol inhibiting fungicides (Kirsten Junker.

Project financed by the National Research Council

During the summer 1985 samples of powdery mildew (*Erysiphe graminis*) were collected in spring and winter barley. The sensitivity of the samples to propiconazol was tested in test tubes. Furthermore trap trays with barley plants, treated with increasing dosages of triadomenol, were placed in the same fields on different dates. It has not been possible to correlate the sensitivity of mildew selected in a single field with the fungicide treatment of the field, neither by means of the trap trays nor the test tubes. This may be due to the fact that the dispersal of mildew from one field to the other is of importance even after the establishment of the attack. The sensitivity of mildew from winter barley seems to be a little lower than that of mildew from spring barley. No significant rise was found in ED_{50} from 1984 to 1985. Tests of "old" isolates show that a decreasing sensitivity of the mildew to ergosterol inhibiting fungicides (particularly C-14 demethyl ring inhibitors). Results from the trap tray method supported this. Tests of single colony isolates have shown a large potential for development of resistance. Whether resistance will become a problem or not in practice depends of the capacity of the resistant strains to survive and reproduce themselves (fitness).

b. Pests in agricultural and outdoor vegetables (Bent Bromand)

Bird-cherry aphids (*Rhopalosiphym padi*), rose-grain aphids (*Metopolophium dirhodum*) and grain aphids (*Sitibion avenae*) in winter wheat and spring barley

In winter wheat attacks started in the beginning of July, and by the end of the month, aphids were found on 90% of the straws. In spring barley attacks started about the 10th June, and a little more than a month later there were severe attacks of aphids on 100% of the straws. 18 experiments were carried out, 6 of them with 3 different times of spraying and 3 different doses. In winter wheat the experiments gave a yield increase of about 6 hkg per ha, and in spring barley the yield increase was 14-15 hkg per ha.

Frit flies (*Oscinella frit*) in cereals, maize and undersown grass

Seed dressing experiments were made in winter wheat. Due to the late time of sowing in the autumn only weak attacks were found, but good effect was obtained with Vitavax RS and Promet 666 SCO.

3 experiments were made in undersown grass. Spraying took place 7-10 days after the cover crops had been harvested. The effect of the pyrethroids was very good, and yield increases of up to 10-15% were seen after 1 spraying.

In maize tests were carried out with 3 pyrethroids, which were applied at the 1-3-leaf stage. A yield increase of almost 50% of the weight of cobs was obtained.

Pests in seed grass, thrips (*Stenothrips graminum*), grass and cereal mite (*Siteroptes graminum*) and (*Ochsenheimeria vaculella*).

In common ryegrass 3 experiments were made with Sumithion 50, several pyrethroids and Pirimor G. The experimental plots were sprayed by the end of June, and grass samples were regularly examined in a Berlese apparatus. In the beginning of June a large number of thrips was found; this number decreased gradually in the course of June. As for the mites the situation was the opposite. The number was comparatively low at the time of spraying, but increased to almost 2000 in 100 grs of grass in late June.

In red fescue and meadow grass the control was directed against the grass and cereal mites only, and spraying was carried out on the 17th May. As for thrips and mites the general picture was similar to that in common ryegrass, but the number of mites increased to 6-7000 per 100 grs of grass by mid July.

In red fescue the number of blasted spikelets caused by (*Ochsenheimeria vaculella*) was almost halfed.

In none of the experiments did the control result in significant yield increases.

Soil-borne pests on sugar beet

In cooperation with the Danish Sugar Factories and the Zoology Department 5 experiments were made with seed dressing, incorporation of granule and spraying against soil-borne pests, such as collembola, millipedes, symphilids, pygmy beetles, wireworms and thrips.

In all the experimental plots where fungicides were incorporated in the pelletization mass, a germination increase of 20-25% was registered.

Pests only occurred to a limited extent, which made it difficult to assess differences, but Promet seed treatment compounds and carbofuran granules had good effect on beet-flies.

Beet-flies (*Pegomya hyoscyami*) in sugar beets

5 experiments were carried out with fenitrothion, dimethoat, pyrethroids and a

mixed compound containing deltamethrin + heptenophos and fenvalerat + fenitrothion. In general the phosphorous compounds were quickest to take effect, followed by the mixed compounds and then the pyrethroids. The overall effect of the pyrethroids was excellent, however.

Black bean aphids (*Aphis fabae*) and peach potato aphid (*Myzus persicae*) in sugar beet

3 experiments were carried out with Sumithion 50, Meta - Systox S-O, Fastac, Sumicombi 30 FW, Cymbush, Karate, Decisquick, Dimethoat D-305 and KVK Dimethoat 400. The only compound which had some, but too little effect, on black bean aphids was Meta-Systox S-O.

On the basis of these results a single experiment was made with several previously approved compounds and Pirimor G. Apart from Pirimor G, Meta - Systox S-O, Anthio, Dimethoat Na 40 EC, Ekatin, Parathion and Sumithion 50 were tested. Pirimor G reduced the percentage of plants attacked from 98% in untreated to 0%. Ekatin reduced the attack to 5% and Meta Systox S-O to 28%, whereas the effect of the other compounds was unsatisfactory.

Blossom beetles (*Meligethes aeneus*), cabbage seed weevils (*Ceutorrhynchus assimilis*) and brassica pod midges (*Dasyneura brassicae*) in rape

The experimental work on spraying with pyrethroids was continued in 1985. In general, the products had good effect against blossom beetles and cabbage seed weevils. 3 experiments with spraying against brassica pod midges gave unsatisfactory effect compared to previous experiments. Rainfall, which delayed spraying, may have contributed to this, but also other factors, which up to now cannot be explained, must have played a role.

Seed dressing against flea beetles (*Phyllotreta* spp.) and thrips (*Thrips*) in winter and spring rape

Thrips occurred only in limited numbers, and in winter rape only weak attacks were seen. In spring rape, however, servere attacks of flea beetles occurred. In general, the compounds had good effect against the flea beetles, particularly the compounds containing furathiocarb. Spraying with Sumithion 20 fW and Sumicidin 10 FW also had good effect.

Seed dressing, incorporation of granule and spraying against pea and bean weevil (*Sitona lineatus*) in peas

In 3 experiments with seed dressing and incorporation of granules no differences were registered in the germination in plots treated with compounds containing fungicides compared to untreated plots. Examination of soil samples showed,

however, that the number of larvae of pea and bean weevils had been reduced from 52 in untreated plots to none or only few in treated plots. In general, the roots in treated plots were healthy, completely white and covered with bacterial tubers, whereas the roots in untreated plots were brown, and almost all the bacterial tubers were more or less eaten up by the larvae.

On an average treatment resulted in a yield increase of 10%.

In 3 spraying experiments leaf gnaws were reduced by about one third. There was no difference in the number of larvae in the soil samples, but all the same the different treatments gave a yield increase of from 6 to 17%. It cannot be explained why spraying gave the same yield increase as seed dressing, which kept the roots completely healthy.

Pea moth (*Cydia nigricana*) and pea aphids (*Acyrthosiphon pisum*) in peas

4 spraying experiments were made. The sprayings were carried out in connection with catches of pea moth males in pheromon traps or at beginning attacks by pea aphids. Pea moth attacks were very few, whereas pea aphid attacks were more widespread.

Sumicombi 30 FW, KVK Dimethoat 400 and 9 pyrethroids were tested. All products had good effect against pea aphids, but the effect of permethrin lasted a little shorter. The yield increase of one spraying was 4-10 hkg per ha.

Control of the cabbage root fly (*Delia brassicae*) on cauliflower

Several experiments were carried out with seed dressing, incorporation of granule, soil drenching before planting and spraying, but with varying results. Soil drenching with Shell Birlane 24 EC and incorporation of granule gave the best effect. The effect obtained with seed dressing did not last long enough, and spraying was too ineffective.

In 1985 a system of forecasts was started based on information sent in by a number of cabbage growers on egg-laying. The egg traps consisting of felt rolls placed around the root collar of the plants. Forecasts on 1st generation were sent out on 24th May and on 2nd generation on 10th July.

Large white butterflies (*Pieris bassicae*) in cabbage

Field and laboratory experiments were carried out with Sumithion 50, Sumicidin 10 FW and Biobit. Biobit is a Bacillus thuringiensis preparation. The spraying was carried out on big larvae. Good effect was obtained, with all the products, but Biobit took effect much slower than the other products.

Samples for residue analyses

The following number of samples were taken out: Wheat 44, spring barley 10, spring rape 22, peas 37, beets 25 and grass 14.

2. HORTICULTURE

a. Fruit growing (E. Schadegg)

Apple scab (*Venturia inaequalis*)

In 1985 infection by apple scab was not as severe as in previous years.

In two experiments the benzimidazol compounds were compared with the ergosterol inhibiting compounds. The benzimidazol compounds had the poorest effect, particularly in the experiment which had given reason to suspect a benzimidazol resistance.

In three other experiments different types of compounds against apple scab were tested.

The ergosterol inhibiting compounds had, as in previous years, the best effect. Best effect was obtained with Topas C 50 WP, but the compound also caused the highest russeting index number. Rubigan gave excellent effect as leaf fungicide, but the protection of the fruits was not as good as that of the leaves. This is in accordance with results from previous experiments. Captan fl. also had good effect against apple scab and the russeting index number was very low. The effect obtained with benomyl was also insufficient in 1985, but the effect was a little better than previous years, however, where the infection by scab was more severe. S. 33086, which is an ergosterol inhibitor, was approved for control of apple scab.

Pear scab (*Venturia pirina*)

The infection by pear scab in the untreated experimental plots was so weak that the experiment could not form the basis for an evaluation of the tested products.

Blossom wilt (*Monilia laxa*) **in cherries**

The severe infections by blossom wilt in sour cherries provided the possibility of testing other types of fungicides than the benzimidazol products. 3 experiments were carried out in sour cherries, Kelleris 16, in a orchard in Nagelsti near Nykøbing F. and in Roneklint near Præstø. Although the experiments did not give a clear result, both the dicarboximides and the ergosterol inhibitors, Saprol, Rubigan, Baycor 25 WP, Topas C 50 WP and Rovral may come into consideration as substitutes for the benzimidazols.

Leaf spot and shot hole (*Blumeriella jaapii*)

In 1985 tests were started of products against leaf spot and shot hole. The first spraying was carried out on 20th May followed by sprayings after each period

with rain, 6 times in all. The experiment showed that products which are effective against apple scab are also suitable for control of leaf spot and shot hole.

The tested products were Baycor 25 WP, Rubigan, Topas C 50 WP and Deland SC 750. In 1986 the intention is to test more products. The establishment of a uniform infection in the cherry plantation of the Research Centre for Plant Protection was successful.

Canker and eye rot (*Nectria galligena*)

At the Research Centre for Plant Protection an experimental method has been tested, which may form the basis for testing compounds against canker and eye rot: On each tree (= replicates) 10 random shoot ends were selected and cut off where they had the thickness of a pencil.

In the preventive experiments the trees were sprayed on 19th June and 21st June and infected with a spore suspension with 7.9×10^6 spores/ml. In the curative experiments the shoot ends were damaged and infected on the same day (19/6). The compounds were applied on 27th June. Otherwise, the method used was the same as that of the preventive experiments. The assessment of the experiments took place 5 months after the treatment, when the length of the lesion was measured. No significant differences were found in the effect of the 3 compounds tested, but the susceptibility of the cultivars differed significantly, however.

The experiment showed that it is possible to infect apple trees artificially with canker and eye rot. Further tests should be made of the method, in which f. inst. another time for causing the lesion and the infection is chosen, which provides a better climate for the fungus. The advantages of this inoculation method is that the assessment of the results is easy and precise.

Winter moths (*Cheimatobia* spp.) **tortrix moths** (*Tortricidae*)

In 1985 three experiments were carried out on control of winter moths and tortrix moths, it was a mixed population, the majority being tortrix moths, however. In all three experiments the attacks were weak, and approval could not be given on the basis of this test.

Fruit tree red spider mites (*Panonychus ulmi*)

In 1985 five experiments were carried out with three replicates of three trees per experimental plot. The compounds were applied according to their mode of action just before the hatching of the winter eggs, at 10% and at 80% hatching.
The hatching of the winter eggs took place very late in two of the experiments, and fewer eggs than expected were hatched. This is probably due to the strong and long winter.

Approved:
Plictran 80, which is a water soluble granule with the same active matter 'cyhexatin' as that of the already approved compound Plictran 25. The compound has a knock-out longterm effect.
Nissorun 10 WP against the winter eggs of the fruit tree red spider mites at 10% hatching with 0.6 kg/ha. Applied on a mixed summer generation the compound had a slower effect. The active matter is hexythiazox.
Apollo 50 SC against the winter eggs of the fruit tree red spider mites, applied at green cluster at the latest, with 0.4 l/ha. Apollo has the best effect when it is applied before the embryonic development of the red spider mites is too advanced. Consequently it can be applied very early and may be used as an alternative to other known compounds against red spider mites.

Green apple aphids (*Aphis pomi*)

The sudden warm wheather in July gave a unusually severe attack of green apple aphids. An experiment was carried out on old trees, on young trees and on apple rootstock. The number of aphids was counted on minimum 10 marked shoots per plot before the spraying.

A dimethoat compound, DLG Dimethoat 305, was approved as well as two pyrethroid compounds, Sumicidin 10 FW and KVK Permethrin.

Leaf blister mites

Due to the sudden occurrence of different species of leaf blister mites in plums and pears in Lolland a control experiment was carried out with compounds which were believed to have an effect against these pests. At the start of the experiments only little was known about the biology of the leaf blister mites, particularly about when the leaf blister mites leave their overwintering sites. Therefore the time for the first spraying was decided on the basis of literature studies of experiments made outside Denmark. The first spraying on 29th April was carried out too early. Consequently a further spraying took place on 14th May.

The following compounds were applied: Thiodan emuls., Vydate L, Gusanthion M WP 25, Monsur and Lannate.

Against the pear leaf blister mite (*Phytoptus pyri*) the effect was satisfactory, against the plum leaf mite (*Asculus fockei*), however, none of the treatments were convincing.

b. Soft fruit, nursery and glasshouse plants (A. Nøhr Rasmussen)

In 1985 85 experiments have been carried out in the above mentioned crops, comprising 25 different pests as well as growth regulation and phytotoxic investigations. Some of the results achieved will be mentioned very briefly below.

Grey mould (*Botrytis cinerea*) on strawberries

In 1983-85 6 experiments have been carried out to re-evaluate 8 approved compounds. The effect against grey mould is measured partly on the basis of the number of diseased and healthy berries, partly on the basis of the yield. Vinclozolin and Dravifol had an effect against grey mould of 73%, thiram and tolylfluanid 61 and 65% respectively. For the other 4 products, iprodion, captan, benomyl and thiophanatmethyl, the effect obtained was between 31 and 46%.

The above mentioned order of products correlates with the yields obtained. On an average vinclozolin and Dravifol gave the best effect with a yield increase compared to untreated of about 55%. Then followed thiram and tolylfluanid with 41%. The difference between these 2 figures is not certain, however. Iprodion, captan, benomyl and thiophanatmethyl gave a very similar effect, but the yield increase obtained with these products was only about 28% compared to untreated.

Leaf spot (*Gloeosporidiella ribis*) on black currants

A re-evaluation of 8 approved products has been started in 1985. In general, the effect was satisfactory, as maneb, mancozeb, captan and thiram provided an effect of between 93 and 99% even for attacks in untreated of 96%.

Tithianon and dinocap + mancozeb had an effect of 83 and 73%, respectively. The effect of benomyl and thiophanatmethyl was below 30%, however.

2 products, which have not yet been marketed in Denmark, penconazol + captan and a new formulation of dithianon, were also tested, and their effect was 99 and 91%, respectively.

American gooseberry mildew (*Sphaerotheca mors-uvae*) on black currants

In 1985 experiments were also started in which 5 approved products were compared. For the best of the products, fenarimol and dinocap + mancozeb, the effect was 69 and 62% respectively, whereas thiophanatmethyl, benomyl and triadimefon gave an effect of only 24, 16 and 10% respectively. 2 products, penconazol + captan and triadimenol, which have not yet been marketed, were also tested, and both had an effect similar to that of fenarimol.

Rust (*Phragmidium mucronatum*) on outdoor roses

In 1985 a series of experiments were started testing products against rust in several nursery plants, e.g. roses. 8 products were tested. Oxycarboxin, triforin, benodanil, chlorothalonil, bitertanol and mepronil gave an effect of between 67 and 100%, whereas the effect of thiophanatmethyl and penconazol was of 70 and 50%, respectively.

Infection by black spot (Diplocarpon rosae) was also seen. Only triforin, chlorothalonil and bitertanol provided sufficient effect against black spot.

Phytophthora in pot plants

Control of *Phytophthora* in pot plants has been tested in each of the crops *Peperomia*, *Saintpaulia* and *Radermachera sinica*. In the experiments etridiazol 35%, etridiazol 70%, furalaxyl and fosetyl-AL were tested and compared, mixed with the pot soil and added to the water applied immediately after the potting. In the experiments artificial infection was applied by adding 10% infected soil to the pot soil.

Furalaxyl gave the best effect in all 3 experiments and with both the two methods of treatment applied. Too many plants died when etridiazol and fosetyl-AL were applied. The effect obtained was better for all the products when added to the water after the potting than mixed with the pot soil.

Greenhouse red spider mites (*Tetranychus urticae*) **in strawberries**

2 experiments were made, where the 1st spraying was carried out after the harvest. Dicofol gave an effect of 100%, fenpropathrin of 99%, whereas amitraz, tetradifon and hexythiazox gave effect of 93 and 97%. The effect obtained when applying endosulfan and oxamyl was only 50-60%.

Strawberry mites (*Steneotarsonemus pallidus*) **in strawberries**

2 experiments have been made with control of strawberry mites, where the sprayings were carried out after the harvest. In one of the experiments two sprayings were carried out with an interval of 14 days, whereas the other was sprayed only once.

The best effect, over 95%, was obtained with endosulfan. Then followed amitraz and dicofol with an effect of 80-85%, whereas fenpropathrin, tetradifon, hexythiazox and oxamyl had only little effect.

2 sprayings increased the effect very little compared to 1 spraying.

Thrips (*Franklinella pallida*) **on** *Saintpaulia*

Control of thrips in pot plants usually causes no problems, but in 1985 a few attacks of thrips were seen in *Saintpaulia*, which proved difficult to control. The species has not been finally determined, but it is supposed to be *Franklinella pallida*, a species, which habits flowers. From Holland it has been reported that the best compound against these thrips is parathion, even though the effect was insufficient.

In a cooperation with the Zoology Department 2 experiments were made, where only 1 spraying was carried out. The effect obtained with parathion was approx. 60%, whereas the effect obtained with 3 pyrethroids, cyfluthrin, fenpropathrin and alphamethrin was 81, 74 and 65%, respectively, compared to untreated.

c. Reduced application of pesticides in fruit trees and bushes by changing dosages and time of spraying (Steen Lykke Nielsen)

Project initiated by the Joint Committee for Agricultural Research and experiments

Black currant gall mites

The migration of the gall mites started by the end of April and ended in the beginning of August.

Several compounds were tested against the gall mites. Endosulfan, oxamyl, methomyl and sulphur-thiram gave the best effect.

Treatment at different times showed that the best effect is obtained with 3 sprayings: at the beginning of the flowering period, at the end of the flowering period and 10-14 days later.

Treatment with spray volumes of from 100 to 1200 l per ha showed that the best effect was obtained with 400 l per ha or higher quantities. The lowest volumes gave a poorer effect. The spray technical experiments in which a florescent colouring matter was used showed an insufficient deposition on the leaves and the axillary buds at the low volumes.

Gassing of black currant cuttings infested with gall mites was tried, using sulfotep and cyanogas. No effect was obtained.

American gooseberry mildew

Spraying with volumes from 200 to 1200 l per ha gave no differences in the effect for the higher volumes, but the effect obtained with 200 l per ha was poorer. The spray technical experiments showed that the poorer effect obtained with 200 l per ha was due to insufficient deposition particularly on the undersides of the leaves.

White-Pine blister rust

Spraying with volumes from 200 to 1200 l per ha and with 2 dosages of triadimefon showed that the best effect was obtained with 400 l per ha or higher volumes. 200l per ha gave a poorer effect.

The lowest dose, which was 75% of the approved dose, gave as good an effect as the approved full dose.

Apple

Due to technical difficulties with the equipment several spray technical experiments were unsuccessful.

Apple scab

No attacks of apple scab were found.

Spraying of dewy leaves

The deposit of pesticide on the apple leaves was doubled when spraying was carried out on dry foliage in the daytime compared to spraying on dewy foliage in the morning. The quantity of liquid applied was 200 l per ha.

Fruit tree red spider mites

Volumes of 200 and 400 l per ha were applied with high and low fluid pressure. All treatments gave 100% effect.

Pear leaf blister mites

Several compounds were applied against the pear leaf blister mites. Spraying at the end of April gave no effect. Spraying by mid May gave good effect. Endosulfan, oxamyl, methomyl and carrbaryl gave good effect.

Plum gall mites

An experiment was carried out similar to that performed on pear leaf blister mites, but the gall mites disappeared all by themselves.

Blossom wilt on cherries

Several compounds were tested against blossom wilt in 'Kelleris 16'. Two quantities of liquid were used: 200 and 400 l per ha. There was no difference in the effect of the two quantities. Irodion, thiophanat and penconazol/captan had the best effect against blossom wilt.

3. New pesticides tested in 1985 (E. Schadegg)

In 1985 the Pesticide Research Institute evaluated a total of 106 fungicides and 59 insecticides, also 59 standard compounds were tested. The compounds were tested against 67 pests in 453 experiments.

The compounds listed below obtained approval:

Seed dressing products

Bunt (*Tilletia caries*)
OE 8302

Thrips (*Thrips augusticeps*)
Promet 800 SCO

Fungicides, sprays

Net blotch (*Drechslera teres*)
Sportak E + Vigil, Corbel + Sportak E (when mixing in tank),
Rival

Powdery mildew in barley (*Erysiphe graminis*)
Sportak E + Vigil, Corbel + Sportak E
(when mixing in tank) Bayfidan DF

Leaf and glume blotch (*Septoria nodorum*)
Corbel + Sportak E, Vigil + Sportak E (when mixing in tank)
Rival

Powdery mildew in wheat (*Erysiphe graminis*)
Corbel + Sportak E, Sportak E + Vigil (when mixing in tank)
Bayfidan DF, Rival

Sclerotinia disease (*Sclerotinia sclerotiorum*)
Ronilan

Eyespot (*Cercosporella herpotrichoides*)
Sportak 45 EC

Powdery mildew on ornamental plants (*Oidium* spp.)
Topas 100 EC

Pythium ultimum (Tulips)
Fongarid 25 WP

Phytophthora spp. (Pot plants)
Fongarid 25 WP

Powdery mildew on roses (*Sphaerothera pannosa*)
Topas 100 EC

Leaf blotch (*Rhynchosporium secalis*)
Sportak E, + Vigil, Corbel + Sportak E
(when mixing in tank) Sportak 45 EC

Didymella stem and fruit rot (*Didymella lycopersici*)
Rovral 50 WP

Apple scab (*Venturia inaequails*)
S 3308 L

Insecticides, sprays.

Larvae of the beet leaf miner (*Pegomyia hyoscyami*)
Cymbush, Decisquick, DLG Dimethoat 305, Fastac, Karate, Sumithion 20 FW

Aphids in cereals (*Macrosiphum avenae* and *Metopolophium dirhodum*)
Cybolt, Cymbush, Decis, DLG Dimethoat, Sumicidin 10 FW, Sumicombi 30 FW

Aphids in peas (*Acrythosiphum pisum*)
Cybolt, Cymbush, Fastac, Karate, Sumicidin 10FW, Sumicombi 30 FW

Peach-potato aphids (*Myzus persicae*)
S 1844

Frit flies (*Oscinella frit*)
Karate

Winter moths (*Cheimatobia spp.*)
Sumicidin 10 FW

Fruit tree red spider mites (*Panonychus ulmi*)
Apollo 50 SC, Nissorun 10 FW, Plictran 80

Blossom beetles (*Meligethes aeneus*)
Fastac, Karate

Tortrix moths (*Tortricidae*)
Sumicidin 10 FW

Leaf miners (*Liriomyza bryoninae*)
Danitol 5 EC, Vertimac

Brassica pod midges (*Dasyneura brassicae*)
Fastac

Seed weevils (*Ceutorrhynchus assimilis*)
Fastac, Karate

Thrips (*Thrips* spp.)
Danitol 5 EC

Apple aphids (*Aphis pomi*)
DLG Dimethoat 305, KVK Permethrin, Sumicidin 10 FW

Greenhouse spider mites on strawberry, blackcurrants and nursery plants (*Tetranychus nurtica*)
Danitol 5 EC, Plictran 80

Insecticides, granules

Beet leaf miners (*Pegomyia hyoscyami*)
Curaterr, Furadan 5 G

Thrips (*Thrips angusticeps*)
Curaterr, Furadan 5 G

The compounds listed below were approved for the first time. As to the rest of the stated compounds, their approval was extended.

Simple compounds		Tank mixtures
Apollo 50 Sl	OE 8302	Corbel + Sportak 45 EC
Bayfidan DF	Plictran 80	Vigil + Sportak 45 EC
Calixin M	Promit 800 SCO	

Deciquick	Rival
DLG Dimethoat 305	S 1844
Fongarid 25 WP	S 3309 L
Nissorun 10 FW	Topas 100 EC

C. PLANT PROTECTION ADVISORY DEPARTMENT, GODTHÅB

Låsbyvej 18, DK-8660 Skanderborg
(A. From Nielsen)

The department's main tasks are advisory work on plant protection, pesticide tests and examination of diseases and physiological conditions especially in potatoes. This work is done in close cooperation with the staff of the National Department of Crop Husbandry.

Advisory work

The work includes answering enquiries concerning plant protection, diagnosing material sent in to the department, working out forecasts and warnings, giving lectures and organizing courses.

1. Experimental work

Frit flies (*Oscinella frit*) (S. Holm

In 1985 frit fly catches were extended to approximately 25 localities mainly in rye grass and oat fields.

The results are used by the local advisers involved. The material also forms the basis of issues of plant protection bulletins.

Even though blue trap trays only provide a rough idea of the migration activity, significant variations have been detected, and local registration/warning should be aimed at in future.

Crane flies (*Tipula paludosa*) (S. Holm)

During the autumn of 1985 a number of grass fields in different localities in Jutland were examined for crane fly densites. The larvae were extracted by means of salt water.

The generally modest occurrence of larvae confirmed expectations of a small occurrence due to wet weather during the period of migration and egg-laying (August/September).

Potato late blight (*Phytophthora infestans*) (S. Holm)

In 1985 the 1st and the 2nd warnings were sent out on the 1st and 19th of July respectively. The 2nd warning, however, was of little value as it was sent out exclusively with a view to a possible application of Ridomil MZ. These fixed dates may from time to time give rise to delayed application of Ridomil, resulting in

too many curative treatments.

In 1985, as in 1982, isolates were found of potato late blight with reduced sensibility to metalaxyl. The isolates occurred especially in potatoes for flour production, and where poor control with Ridomil MZ in practice was found.

Control of black scurf and stem canker (*Rhizoctonia solani*) in presprouted potatoes (J. Bak Henriksen)

Methods of controlling black scurf and stem canker in presprouted potatoes were tested in 2 experiments, in which fog spraying with Tecto L and Orbivet were compared to applying Rovral Flo and Tecto L in the planting machine in one experiment and to spraying of the tubers after they had been sown, but before the rows had been covered by the hoes in the other experiment. Attacks on the sprouts were only found in one experiment, and all treatments reduced the severity of the attacks. In one experiment the treatments also reduced the formation of sclerotia on the tubers.

Irrigation strategy and infection with black leg/soft rot (*Erwinia* sp.) (J. Bak Henriksen)

The experiment was made in connection with a project: Irrigation strategy, yield and quality, at St. Jyndevad, where not inoculated tubers and tubers inoculated with *Erwinia corotovora* var. *atroseptica* were sown at 3 different irrigation regiments. Due to a low precipitation deficit in 1985, only little watering was done even in the experimental plot receiving "frequent irrigation". The cultivar was 'Tylva', and the attack of black leg increased drastically late in the growing season to between 15 and 30% in plants after the inoculated tubers and to 6-8% in plants after not inoculated tubers. The yield of the inoculated tubers was considerably smaller in hkg/ha (an average of 497 hkg against 642 hkg for not inoculated tubers). The number of tubers per ha was highest, however, for inoculated tubers, which therefore gave many small tubers, < 40 mm.

D. INSTITUTE OF WEED CONTROL

Flakkebjerg, DK-4200 Slagelse
(K.E. Thonke)

I. FIELD OF ACTIVITY

The Institute continued its research and experimental work within the areas of weed biology and weed control, in the widest sense of these words including herbicide testing and giving approval for use. In addition, the Institute is responsible for research, testing and giving approval for use of growth regulators for agricultural crops.

Distribution of main tasks

Field trials concerning development, testing and advisory work in agricultural crops (Ole Permin)
Testing of herbicides, desiccants and growth regulators in agricultural crops. (Egon Juhl Petersen and Peder elbæk Jensen).
Re-evaluation and evaluation of efficacy (E. Juhl Petersen, G. Noyé and T. Rubow).
Horticulture (Georg Noyé).
Forestry, windbreaks and coverts (T. Rubow).
Weed biology (C. Holm-Nielsen assisted by S. Thorup).
Experiments in containers and climate chambers.
Herbicide persistence and the rain-fastness of herbicide mixtures (Per Nielsen Kudsk and Knud Erich Thonke og Jens Lindegaard Kristensen).
After effect of herbicides in soil (Johannes Røyevik).
The advisory service (Karen Ravn).

II. AGRICULTURE

1. Field trials concerning development, testing and advisory work in agricultural crops.

Control of common couch (*Elymus repens*) (O. Permin)

The long-term effect of chemical products applied to control Elymus repens has been investigated. The basis for the experiment are 15 cm long rhizome pieces planted in each plot in October, 1984. In 1985 beet were sown on the experimental area and treated twice with 1, 1/2 and 1/4 of the normal dose of fluazifop-butyl (Fusilade). When 1/2 and 1/4 of the normal dose was applied a few Elymus repens plants were capable of continuing growth, though this was reduced by the competition from the beet. After the beet were harvested, the dug up shoots of Elymus repens which had been treated with a normal dose were unable to form

new shoots when left to germinate under laboratory conditions. The long-term effect of the treatment will be investigated in spring barley in 1986. The test was ordered by ICI.

Control of wild oat-grass (*Avena fatua*) (O. Permin)

Experiments were continued to examine how quickly cultivated land is emptied of viable Avena fatua seeds when a ploughfree cultivation method is used. Grains of Avena fatua were sown in depths of 5, 15 and 30 cm in the autumn of 1980.

Direct drilling without an initial preparation of the stubble field in the autumn gave the least number of germinated wild oat plants, and then only from a depth of 5 cm. The more intensive the preparation of the soil the greater the number of wild oat plants which germinated, and the greatest number was found where ploughing had been carried out. For the first three years wild oat seeds which had been sown in a depth of 15 cm also germinated, but no germination was registered from seeds sown at a depth of 30 cm. After 5 years no wild oat plants germinated from the seeds sown. In the years to come germination ability of the remaining seeds will be examined.

Tolerance trials in winter crops (O. Permin)

In tolerance trials with 7 varieties of winter wheat, chlortoluron (Dicuran 500 FW), applied in increasing doses and at two different times have been tested. No damage was found in the cultivars Kraka and Disponent when sprayed immediately after sowing and after germination in November. Imba, Kosak and Calif tolerated treatment both with normal and double doses applied just after sowing. Sleipner and Citadel tolerated normal doses but not double doses immediately after the sowing. Double doses applied after germination caused severe damage on the varieties Kosak, Sleipner, Calif and Citadel. The experimental work has been carried out for Ciba Geigy. The tolerance test with chlortoluron included 5 varieties of winter barley, Igri, Gerbel, Hasso, Mammut and Freya. None of them survived the winter. The experimental plot was resown in the spring with barley, spring oilseed rape, peas and beet without previous ploughing. The yield of all the varieties sown tended to be reduced where a double dose of chlortoluron had been applied in the autumn. In the course of the growing season in June severe visible damage was found in all the varieties. Undersown crops of grass and clover in barley were completely destroyed.

Orientating experiments on the effect of hormonal compounds in winter wheat applied in the autumn showed damage in the wheat which reduced its ability to overwinter. The hormonal compounds of the ester type were not found to cause any severe damage.

Tolerance trials in peas (O. Permin)

Experiments were carried out in peas to test their tolerance to combinations of soil and leaf-applied herbicides. If the control of the weed turns out to be unsatisfactory, it may, in practice be necessary to use leaf-applied herbicides also.

The residual compounds trifluralin (Treflan), cyanazin (Bladex) and pendimethalin (Stomp) did not damage the yield of peas when applied in a combination with the leaf-applied herbicides bentazon (Basagran) and bentazon + cyanazin (Basagran + Bladex). Also, no yield decrease was registered when bentazon (Basagran) was applied in a mixture with MCPA or MCPB. The mixture containing MCPB was less harmful to the peas than MCPA.

Control of common couch (Elymus repens) and pests often coincides with the herbicide applications. In an orientating experiment the tolerance of the peas to mixed compounds was tested. Some of the peas had received a preceding treatment of soil compounds, some had not. The soil compounds have been applied in normal and double doses, and mixtures of leaf-applied compounds Parathion fl. and as a powder fluazifop-butyl (Fusilade) with Actipron or Lissapol Plus added. When Actipron or flowable Parathion were added to the mixture bentazon, MCPA (Basagran, MCPA) + cyanazin (Bladex) the peas showed signs of damage. The same was the case if oil and Parathion in powder was added to the mixture. Addition of fluazifop-butyl (Fusilade) and LIssapol to the mixture also had a damaging effect on the peas.

Tolerance trials in field beans (O. Permin)

Satisfactory weed control in field bean growing is a decisive problem, which could previously only be solved partly by either applying linuron (Afalon) or dinoseb. Out of a number of leaf-applied compounds, which have been tested in orientating trials, there seems to be good possibilities for using bentazon (Basagran) and bentazon (Basagran) + cyanazin (Bladex).

An experiment on the effect of a number of soil herbicides combined with irrigation, equivalent to precipitation amounts of 0, 10 and 30 mm, immediately after application of treatment showed that, apart from linuron (Afalon), it is possible to apply cyanazin and lenacil (Venzar) without causing damage to the field beans, but lenacil showed poor weed control.

Tolerance trials in flax (O. Permin)

The object of the trial is to find alternatives to DNOC, which was previously used on flax. Orientating trials using 3 doses showed that possibilities are good for using bentazon (Basagran), with or without MCPA, bromoxynil (Brominal), chlorsulfuron (Glean) and dichlorpicolin acid (Matrigon).

The application of a number of soil herbicides immediately after sowing was tested. Chlorsulfuron (Glean) when combined with irrigation equivalent to 10 and 30 mm severely damaged the flax. Treflan damaged the flax both with and without irrigation. It seems possible, however, to apply a mixture of linuron (Afalon) and lenacil (Venzar).

Effect of herbicides on undersown crops (O. Permin)

The object of the experiment was to assess the effect of new herbicides on crop plants used as cover crops or undersown crops. The experiment does not only provide information on tolerant crops which consequently can be used as undersown crops, but also on the possibilities of controlling volunteers from different crops. Residual and leaf-applied herbicides are used in the experiment to control dicotyledonous weeds in peas. The crop plants, which were sprayed simultaneously and at the optimal time for spraying peas, were: 1. spring oil seed rape, 2. caraway, 3. flax, 4. peas, 5. field beans, 6. lupin, 7. white clover, 8. red clover, 9. lucerne, 10. spring barley, 11. spring wheat, 12. Italian ryegrass, 13. meadow grass, 14. meadow fescue, 15. red fescue, 16. beet, 17. swedes.

The visual assessment showed that cyanazin (Bladex) caused severe damage to all the crop plants, except peas, field beans and lupin. The leaf-applied compounds that consisted of bentazon (Basagran) or mixtures of bentazon (Basagran) and cyanazin (Bladex) and MCPA or MCPB caused damage to all lupins.

Time of spraying and additives for herbicides in beet (O. Permin)

Reduced doses make it necessary to carry out treatment at the correct stage of development and when the climatic conditions are favourable for the effect of the compounds. Often, the best time for treatment coincides with the germination of the beet, and this may cause damage to the beet. The compounds phenmedipham (Betanal), metamitron (Goltix) and ethofumesate (Nortron) were applied in mixtures and using small and large doses. The result, which was assessed from a registration of the yield, showed that small doses like Betanal + Goltix 2 l + 2 kg/ha or Betanal + Nortron, 2 l + 2 l/ha did not damage the beet, whereas Betanal 6 l/ha and Betanal + Nortron 4 l + 4 l/ha tended to reduce the number of beet per ha when applied at the cotyledon stage.

Technical spray experiments (O. Permin)

The work is coordinated in a committee within the Research Centre for Plant Protection. The work is interdisciplinary and comprises interdisciplinary projects in which The Crop Husbandry Department and Danish Agricultural Engineering Institute participate. The object is to optimize spraying techniques which is an essential element in the efforts to reduce doses and to avoid an unnecessary strain on the environment. The trials which have been carried out in agricultural

crops for the Institute of Weed Control will be mentioned below.

Technical Spray experiments with herbicides (O. Permin)

Experiments were carried out with 4 different sizes of nozzles 4110-10, 4110-14, 4110-16 and 4110-24 at 3 different pressures 1.5, 3.0 and 6.0 bar, so that the liquid quantity varied from 53 up to 497 l liquid per ha. A systemic herbicide was applied against dicotyledonous weeds in spring barley. The preliminary result showed that by applying both at an early and a late development stage the effect tended to be less with the smallest nozzle 4110-10 compared with the nozzles 4110-14, -16 and -24.

An experiment ordered by NAB to test the influence of quantity of liquid on the effect of difenzoquat in double, normal, 1/2 and 1/4 of normal doses showed a significantly better effect against wild oats when 1/2 and 1/4 of normal doses were diluted in 75 l of liquid compared to 300 l of liquid per ha.

Technical spray experiments with fungicides (O. Permin)

Experiments were carried out in spring barley on the biological effect of propiconazol (Tilt 250 EC) propiconazol + tridemorph (Tilt turbo 475 EC) using different spraying systems. 1/2 and 1/4 of normal doses tended to improve the effect against mildew when a crop opener was used and a pneumatic nozzle. A crop opener is a boom which is lowered to say half the height of the crop making an opening into which the spray is applied. In a pneumatic nozzle a stream of air is added in the nozzle. There was no definite improvement in the effect of the other spraying systems compared to the standard, which was nozzle 4110-14, 3 bar and 150 l of liquid per ha at a forward speed of 7 km/h.

Examinations of the spray deposit on the plants showed a significantly increased deposition on the middle and lowest parts of the leaves and stems, when a crop opener was used.

Experimental work was done for Ciba Geigy.

Application with specialized sprayers, such as Danfoil at 45 and 60 l of liquid per ha and the CDA sprayer at 10 l per ha, and 1/2 of normal dose gave satisfactory effect against mildew. The effect obtained using the specialized sprayers was not better than that obtained with the hydraulic field sprayer with nozzle 4110-10, 3 bar and 75 l of liquid per ha.

Technical spray experiments with growth regulators (O. Permin)

The effect of ethephon (Cerone) on spring barley in liquid volumes of 250, 125

and 62 l of liquid per ha has been examined. Flat fan nozzles 4110-24, -16 and-10 at 3 bar and at a forward speed of 7 km/h were used. The effect has been assessed by measuring the straw length. The results from 3 years' trials show that spraying with Cerone in 2/3 of normal dose without wetter in 62 l liquid per ha gave a reduction in straw lenght similar to that obtained with a normal dose and 250 l of liquid per ha. Adding wetter (0.1% Sandovit) gave an increase in the straw length reduction effect, so that 2/3 of the dose + wetter corresponded to normal dose without wetter. When wetter was added, a reduction of the liquid volume did not increase the effect significantly, but 125 l tended to give a better straw length reduction effect than 250 l of liquid per ha. 67 l of liquid per ha was not quite as stable as 125 l of liquid per ha.

In a orientating experiment it was examined as to whether the quantity of liquid used to distribute ethephon (Cerone) could, advantagously, be reduced, when the plants were covered with dew. The result showed a better straw reduction effect with 100 l than with 200 l of liquid per ha when application took place in the morning with a high atmospheric humidity, both with and without dew on the plants. The effect was poorer when spraying took place later in the day in a lower atmospheric humidity.

2. Experiments with herbicides, desiccation compounds and growth regulators in agricultural crops (E. Juhl Petersen and P. Elbæk Jensen

The testing carried out in 1985 was still very much influenced by the interest in the use of herbicides in winter crops. Many of these compounds were sent in for testing for use in the autumn, and in the autumn of 1984 a number of experiments were made in the 3 winter crops, wheat, barley and rye.

The hard winter of 1984-85 caused crop failure in the winter barley experiments and the experiments with Longbow and Falke wheat, which accounted for 50% of the experiments made. A registration of the weed was carried out before the re-sowing of these fields. Consequently it was possible even at this early stage to obtain an impression of the effect of the compounds. The frost damage was so encompassing that it was impossible to estimate whether the herbicides applied had added to the failure of the crop.

The overwintered experiments were damaged to a greater or lesser degree by water during the thaw, and this resulted in some uncertain yield assessments.
Several analogues of chlorsulfuron were sent in for testing in cereals, each of them having slightly different weed control properties. A couple of completely new active chemicals, diflufenican and isoxaben, had a broad and good effect against weeds when used in winter cereals in the autumn. In beet different

phenmedipham compounds were tested and also a new water-based formulation, a so-called flowable formulation. The effect of this compound on the weeds was very much poorer than the usual emulsion concentrates, which emphasises the great importance of the formulation on the effect of phenmedipham.
In peas, both residual herbicides and leaf-applied herbicides in the form of tank mixtures of cyanazin and MCPB or bentazan were tested. The tested residual compounds had a more unreliable effect than the tank mixtures.

Desiccation experiments were carried out in peas, rape and potatoes. None of the tested compounds took effect as quickly as diquat (Reglone), but in an experiment in spring rape the quick desiccation was a disadvantage, as a few days before the havesting the early autumn gale in September blew off about 80% of the seeds in the experiment.

Experiments with growth regulators were carried out in grass seed, rape and cereals. Two new types of chemicals, paclobutrazol and triapentenol were mainly tested. These compounds are chiefly taken up by the roots. Therefore it is essential that the soil is moist when sprayed. In experiments in cocksfoot, red fescue and ryegrass, these compounds had a good straw reducing effect, impeded or delayed lodging and gave good yield increases. The future of these compounds is, despite the good result in 1985, perhaps somewhat uncertain, as paclobutrazol is very persistent in the soil and may have an adversely effect on the succeeding crop. Triapentenol is perhaps, because of the chemical similarity to certain fungicides, contributing to a development of fungicide resistence, which will strongly limit the areas of application of the compound.

By the end of the year 28 compounds were approved of which 12 as yet had not been authorized by the National Agency of Environmental Protection.

3. Re-evaluation and evaluation of efficacy (E. Juhl Petersen, G. Noyé and T. Rubow).

In connection with the re-evaluation of the older chemicals ordered by the National Agency of Environmental Protection, an evaluation of application and of the consequences of limiting or withdrawing approvals for dichlobenil, petroleum oil and alachlor was carried out in 1985.

Supplementary statements were given concerning a re-evaluation of atrazine, and negotiations were conducted with the Agency's Bureau of Chemicals and Pesticides concerning alternatives to the phenol compounds.

As the National Agency of Environmental Protection has not been able to re-evaluate all the compounds approved by the Toxicological Board before 1st January,

1986, it has been stipulated that all applications for approval of compounds sent in after 1st January, 1986 must be treated as new compounds with regard to documentation and evaluation, this also include known active ingredients.

This resulted in a stream of applications for approval late in the year, followed by inquiries from the National Agency of Environmental Protection to the Research Centre for Plant Protection for evaluations of efficacy of these compounds.

In 1985, 15 evaluations of efficacy were carried out in connection with the application to the National Agency of Environmental Protection for approval of herbicides and growth regulators. During the last month of the year, 10 more applications were received, which could not be examined until the beginning of 1986, because they arrived as the year's evaluation was being finalized.

All the evaluated products contained known active ingredients.

III. HORTICULTURE

(Georg Noyé)

1985 was very much influenced by the distribution of rainfall which caused the soil to be more or less moist in the surface throughout all the growing season. Consequently, all the soil herbicides were extremely effective from the beginning of the year - in all crops with a "short growing season" most of the weed problems were solved by applying residual herbicides only, whereas the crops of longer duration were well established before further treatment became necessary.

In the long term crops such as fruit and berry and nurseries the "wet" soil caused the degradation of otherwise persistent herbicides to take place so quickly that the soil herbicides did not have the intended long-term effect. The lack of a long-term effect, together with herbicide tolerant (resistent) weeds provoked a large increase in the test work with alternative residual herbicides and supplementary leaf-applied herbicides in horticultural crops.

IV. FORESTRY, WINDBREAKS

(T. Rubow)

Herbicide tolerance in frost injured coniferous plants

It is commonly believed that weakened (cultivated) plants are generally more sensitive to herbicides than healthy plants. The hard winter, which resulted in very widespread frost injuries in all sorts of tree species, offered the opportunity to examine whether frost damaged conifers (Caucasian fir) would react differently to herbicide treatment than undamaged individuals of the same species.

In the course of the year no difference could be seen in the reaction of the two populations to the spring sprayings carried out using the residual herbicides atrazine and hexazinon in varying doses.

Tank mixtures of atrazin and hexazinon

These two compounds are widely applied in a number of coniferous species. Atrazine is cheap, but application over a period of several years leads to a propagation of hardy/resistent weeds. Hexazinon is a very expensive herbicide with a broader effect than atrazine. According to reports from growers, tank mixtures of the two herbicides had given such convincing weed control results that a synergistic effect was probable.

The experimental work done so far seems to indicate that this is not the case, as the results show that hexazinon "is doing the job".

Control of field bindweed

Field bindweed is a common, but not very widespread weed in Christmas tree species planted on arable land. Where the plant immigrated, it has an extremely harmful effect on the shape and appearance of the tree.

In recent years, a number of tolerance and control experiments have been carried out with different hormone compounds. The result is still that MCPA-salt combinations are the most suitable. It appears that control should be carried out as an overall application, despite the fact that the field bindweed tends to occur in patches and groups, because spot sprayings often imply overdosing and injuries.

Approvals

Experimental work carried out over several years - first and foremost as investigations of tolerance - with the herbicides clopyralid (formerly dichlorpicolinic acid) and fluazifop-butyl has led to an approval of the former of

for the control of composite weeds in certain coniferous species and of the latter for the control of couch in all tree species.

Experiments with regard to an extension of the approval of clopyralid has been started in amongst other things windbreaks.

V. WEED BIOLOGY, DISTRIBUTION AND SPREADING

(C. Holm-Nielsen assisted by S. Thorup)

Collection of data, i.e. counts in May of number and species of weeds and counts and weighing of these in July, was carried out in plots started in 1982 with a view to investigate the development of the weed flora in relation to soil treatment with and without herbicide treatment.

The weed counts carried out in the spring, and just before the harvest at farms where crops have been grown with non-ploughed but harrowed soil/direct drilling for more than 30 years were continued in the same form as the preceding years.

To investigate the soil seed bank work was initiated to develop a technique for finding seed.

VI. THE PERSISTENCE OF HERBICIDES IN SOIL

(Johannes Røyrvik)

Outdoor degradation of chlorsulfuron (Glean), DFX L 5300 and CGA 131'036

The outdoor experiment was started in spring 1985. Soil samples were taken approx. every 6 weeks for biological tests in controlled environment chambers. The test plant used was spring rape (Topas). Similar experiments with chlorsulfuron were carried out in 1983 and 1984. The results indicate that rainfall has an influence on the degradation, as increased rainfall during the test period from 1983 to 1985 gave a quicker degradation of chlorsulfuron. Temperature, however, does not seem to affect the degradation very much, probably due to the relatively small variations from one year to another.

Whereas DPX L 5300 had a very short degradation period, it was obvious that CGA 131'036 was more persistent in the soil than chlorsulfuron. The last two herbicides must be considered as belonging to the group of herbicides with a relatively long persistence.

Biological test of straw samples from barley and wheat sprayed with herbicides

Biological tests have been carried out on straw samples from barley, which had been treated with 1.44 kg/ha glyphosat (Roundup). The samples were taken at different times after the application (0-10 days). The test plants were winter wheat (Kraka) and fibre flax (Regina). In the first samples, 0-3 days after the application, severe injuries were seen on the test plants, and even in the samples taken 10 days after the spraying, the weight of the newly collected winter wheat was less than half the weight of the untreated winter wheat. In the period from application to the last sampling the rainfall was 38 mm.

Biological tests were also carrried out on straw samples from wheat and barley which had been treated with 0.2 kg/ha clopyralid (Matrigon). The test plants were chrysanthemum cv. and tomato (Wilset). Severe injuries were registered on both test plants caused by both the wheat and barley straw samples.

VII. CONTROLLED ENVIRONMENT DEPARTMENT

(P. Kudsk and K.E. Thonke)

Investigation into rainfastness of herbicides and herbicide mixtures

In 1985 a rain simulator was installed at the Institute, which has been used througout the year for a number of investigations into the rainfastness of herbicides and herbicide mixtures.

In one of the experiments the rainfastness of the two compounds against wild oat, difenzoquat (Avenge) and flamprop-isopropyl (Barnon Plus), was examined. The experiment showed that whereas difenzoquat required more than 4 1/2 hours' dry weather to take full effect, 1 1/2 hour of dry weather was sufficient for flamprop-isopropyl. The results also showed that it was possible to assess the experiment by means of an "parallel-line assay", i.e. the curves of doses for the effect with and without rain are parallel, and the distance between the two curves of doses indicates how much effect is lost as a result of rain. Furthermore, it was found that application in a mixture with propiconazol (Tilt) had no influence on the rainfastness of difenzoquat.

In another experiment the effect and rainfastness of a mechlorprop-salt was examined when applied alone and in a mixture with the fingicide maneb. The results showed that application in tank mixtures with maneb reduced the effect of the hormone compound, and that this reduction in effect was greatest in connection with rain, which means that maneb also reduced the rainfastness. With the applied doses 6 hours' dry weather was necessary to obtain the full effect of the mechlorprop-salt, whereas 8 hours were necessary when application took place in a mixture with maneb.

The rainfastness of the two couch herbicides, glyphosate (Roundup) and haloxyfob-ethoxyethyl (Gallant) was examined using spring barley as test plant. The two herbicides were applied alone and in mixtures with a vegetable oil or a non-ionic wetter. Addition of oil or wetter had no influence on the effect of haloxyfob-ethoxyethyl, but increased the rainfastness. The vegetable oil, however, reduced both the effect and the rainfastness of glyphosate, whereas the wetter increased both the effect and the rainfastness.

In two experiments with barley and common couch (Elymus repens) as test plants, the effect on the rainfastness of a number of additives were tested, among them some so-called "rainfastners". The experiments showed that several additives can increase the rainfastness of glyphosat, primarily due to a greater assimilation of glyphosate and not because of a better adherence to the leaves.

Technical spray experiments

The importance of spray volume and of droplet size for the effect of glyphosat (Roundup) was examined with spring barley as test plant. By varying both the forward speed and the size of nozzles it was possible to examine the effect of the 2 factors seperately.

The results showed that the spray volume was more important than the size of the droplets, which indicates that the concentration of the spray droplets is of essential importance to the effect. The poorer effect obtained by varying the size of the droplets may be due to the fact that the foliage was very dense, and that consequently the droplets, if they were reflected from the first leaves, would land on other leaves. Furthermore, the experiment also showed that in experiments where spray technical parameters are changed "parallel-line assays" can be used in the assessment of the experiment.

As a follow-up to last year's experiment of application of difenzoquat (Avenge) in reduced spray volumes, the tolerance of the spring barley was examined. The more concentrated spray did not cause more damage to the plants, neither at normal soil moisture nor when the barley plants were under water stress. Consequently, a reduction of the spray volume of difenzoquat does not reduce the tolerance of the crop.

Experiments with new phenmedipham formulations

Also this year a number of ordered experiments have been carried out with new phenmedipham formulations. Furthermore, a comparison has been made between the marketed formulations when applied alone and in mixtures with metamitron (Goltix). Only small differences were found between the marketed formulations, and these differences disappeared when the formulations were applied in tank mixtures with metamitron.

Climate chamber experiments with new active ingredients

The influence of temperature and atmospheric humidity on the effect of DPX L5300 and 131'036 on white mustard (Sinapis alba) was examined in climatic chambers. Both these active ingredients belong to the sulfonylurea group.

The effect of CGA 131'036 turned out to be just as dependent on temperature and atmospheric humidity as chlorsulfuron (Glean), whereas DPX L5300 was considerably less dependent on these climatic factors than the other sulfonylurea herbicides examined. Addition of 0.1% Citowett could eliminate the dependence of atmospheric humidity of both the active ingredients, but did not change the temperature dependence.

An experiment comparing a mechlorprop-octylester and a mechlorprop-bisester was also made. In the experiment the effect and the dependence on the effect of temperature and atmospheric humidity was examined. No difference in the effect was found, and both the formulations showed almost no dependence of atmospheric humidity, whereas they were very temperature dependent.

Experiments with growth regulators

This year, growth regulators have been examined in oilseed rape and maize.

In oilseed rape the effect of different mixtures of pachlobutrazol and chlormequat-chlorid (Cycocel Ekstra) was examined. As the purpose was only to examine the effect at leaf uptake, the growth regulators were applied in mixtures with different additives. It was not possible to find any appreciable effect on the leaves from paclobutrazol. nor applied in mixtures with additives. Thus, paclobutrazol in oilseed rape must be considered to be an almost 100% residual applied compound.

In maize the effect of chlormequat-chlorid applied at different stages of development was examined. The experiment showed that it was only possible to obtain small reductions in height with chlormequat-chlorid and only at the late development stages (10-12-leaf-stage). The same result was found in a field experiment, which was carried out simultaneously. If the poor effect of chlormequat-chlorid is correlated to the good effect obtained in 1984 with ethephon (Cerone) and ethephon + chlormequat-chlorid (Terpal C), there is an indication that ethephon has a stronger growth regulating effect than chlormequat-chlorid.

VIII. ADVISORY WORK

(Karen Ravn)

The amount and distribution of enquiries via the telephone were in 1985 the same as in previous years. There was an increasing number of enquiries about weed control in oilseed rape, peas and maize, whereas enquiries about weed control in cereals decreased. Similar to previous years, there have been several enquiries concerning erroneous treatments and possible secondary crops and weed problems detected too late so that normal treatment would not be possible. In these areas test results are lacking, and a number of these enquiries were followed up by visits in the field.

Lectures and seminars

During the year staff members gave 119 lectures at meetings and seminars, including lectures at the 12 spraying courses which took place all over the country. Several lectures have also been given at the courses organized at Tune Agricultural Course Centre for agricultural advisors.

Agricultural advisors

The local agricultural advisors arrange excursions during May and June, where the problems are discussed in the field. A representative of the Institute of Weed Control has taken part in these inspection tours. 27 excursions with advisors or similar inspections took place in 1985.

E. LABORATORY FOR PESTICIDE ANALYSIS

I. FIELD OF ACTIVITY

The main tasks are examinations of pesticides as to persistence, degradation and leaching in soil and their absorption, transportation and metabolizing in plants. Besides, the influence of pesticides on the nutritive value of some crops and on microorganisms in soil is examined.

Distribution of main tasks

The effect of pesticides on the microflora (Susanne Elmholt)
Registration of pesticides in groundwater (Gitte Felding)
Degradation of pesticides, etc. in soil (Arne Helweg)
Fungicides and insecticides in plants (Erik Kirknel)
Herbicides in plants (Peder Odgaard)

Effect of fungicides on the fungal flora in soil from cereal crops (Susanne Elmholt)

The Research Council grant, initially given for two years, took effect on 1st June, 1985. Since the start of the project facilities for microbiological work have been constructed at the Laboratory for Pesticide Analysis.

In 1985, field trials have been carried out with 4 doses of Tilt 250 EC and seven blocks. The following was investigated: The deposition of the spray on the soil, various aspects in connection with taking out undisturbed soil samples in different depths, residue concentrations of propiconazol in the uppermost soil layers and to a certain extent the fungal flora on the aerial parts of the plant. Furthermore, the fungal flora of the soil has been investigated before treatment and three times after treatment with Tilt. The investigations have been concentrated on evaluating the relationship between direct and indirect effects of treatment and on analysing some problems of methods in connection with qualitative investigations of the saprophytic fungal flora of the soil.

Registration of occurrence of pesticides in drain and ground water (Gitte Felding)

In the first samples taken, the registration was concentrated on the herbicide atrazine and products of the phenoxy acid group (MCPA and dichlorprop) as well as the phenols which may be produced during their degradation.

The phenoxy acids have been selected because of their widespread use (they make up about 1/3 of the total sale of pesticides), atrazin has been found in the ground water in the USA and in Germany. As, moreover, parts of Western Jutland has a geology which is similar to that of the areas in Germany where atrazine was found, atrazine was chosen.

In cooperation with the Danish Geological Survey, areas around Ølgod and Løgumkloster have been selected. The areas have a cover layer of sand, the ground water level is high (1.5-2 m). The crop pattern has not changed during the last 10 years.

The actual sampling was carried out by DGS's drilling team. Three bore holes were made per field, and from each hole water samples were taken at three levels within the uppermost meter below ground water level. The water samples were filtered and extracted immediately after they had been taken out. They are kept in a dark place at 4°C until the analyses take place.

The atrazine is measured gaschromatographically with a NP-detector, the phenoxy acids are derivated and afterwards gaschromatographically measured with a EC detector. The final identification is carried out with a massspectrometer as detector.

Influence of the soil temperature and the water content on the degradation of pesticides (Arne Helweg)

Investigations have been made with ^{14}C-labelled MCPA, as this type of investigations have not been made for MCPA.

The temperature effect during the first days is a trebling approx. of the rate of degradation with each rise of the temperature of 10°C. This correlation does not continue, when the exponentially increasing degradation of MCPA starts after some few days.

Degradation of pesticides in subsurface soils (Arne Helweg).

The Research Council project was continued, and experiments were made to try to clarify the capacity of different soil samples to degradate pesticides. The previous results gave reason to believe that the content of nitrate of the soil was a main explanation, but this was not confirmed.

Influence of commercial use of pesticides on the microbial activity in soil (Arne Helweg)

The biological degradation in soil from normally sprayed orchards and in soil from organically grown orchards does not appear to differ much. The biological activity was determined by the velocity of some biological processes in soil (ammonification, nitrification, respiration, non-symbiotic N_2-fixation, degradation of ^{14}C-labelled haulm and degradation of ^{14}C-labelled parathion).

Fungicide uptake in barley under varying climatic conditions (Erik Kirknel)

In connection with this project an investigation has been carried out in 1985 in cooperation with The Carlsberg Laboratories on the correlation between residues of Tilt (propiconazol) on spring barley, fungal infection, yield increase and the RNA-content in the barley plant. Spraying was carried out in two fashions: An early (1/2 dose) and a normal spraying (full dose) as well as 1/3 and 1/9 of this dose. 1985 turned out to be a year with very weak attacks of mildew, consequently the experiment showed the effect of these treatments on plants which were not infected with mildew or infected far below the injury threshold. The effect registered on the yield increases can probably be ascribed to saprophytic fungi or a direct plant physiological effect of a growth hormonal character. The statistical analyses clearly show that with normal doses yields could be increased by 7-9%, with reduced doses of 1/3 of the normal doses the yield increase was of 2-3%. 1/9 of the normal doses gave no significant effect. About 500 leaf samples have been taken for residual analyses, which are being carried out. The RNA analyses have been initiated on The Carlsberg Laboratories. The purpose of the project is more precisely to be able to establish a correlation between residues in the plants, the dependence of these of climatic conditions from year to year, and yield increases. This will provide the possibility of reducing fungicide doses in benefit of the environment and of the economy of grain growing.

The experiments will be continued in 1986 in an almost unchanged fashion with 3 cultivars of spring barley in co-operation with the Carlsberg Laboratories.

The results from 1985 indicate that an injury threshold for mildew alone does not give sufficient background for initiating a fungicide treatment on spring barley.

Influence of pesticides on nutritional value of cereals and potatoes (Erik Kirknel).

This Research Council project ended after two years' work. The last residual analyses for propiconazol in cereals have almost been completed. Only very small quantities of propiconazol were found in barley and wheat even after three sprayings with normal doses. Maximum residues are 15 ppb.

Feeding experiments carried out in 1984 were easily interpreted. There were good explanations for the changed nutritional values resulting from the fungicide treatments, namely a yield increase, a reduced protein content and consequently a changed nutritional value. In 1985 it was difficult to see the same correlation between yields and protein content. There seems to be a fairly good correlation between protein content and the changed nutritional values. The final conclusion for 1985 is not yet at hand, but there is every indication that better growth conditions for the plants result in changed nutritional values.

During the first year of the potato experiment, chemical analyses were made for several nutritionally important parameters. The spraying program, which consists of several treatments with normal, 1/4 and 4 times normal doses of two fungicides and one insecticide, seemed to have no significant effect on these components. In 1985 the crop sprayed was not analyzed for these nutrients, but feeding experiments are carried out with rats, in which the nutritional values is determined. These results are expected to be available by mid-Winter. It is the intention to continue the activities in this area. Especially fruit and vegetables are potential crops. Financial support has been applied for in the Research Councils.

Herbicides in green plant material and silage of whole-crop, on which weed control has been carried out (Peder Odgaard)

Analyses for MCPA and dicamba continued and are expected to be finished soon. Dicamba was in the experiments applied together with MCPA and only in normal dosage (70 g/ha). This does cause some difficulties at the quantification of dicamba (gaschromatographically).

The MCPA concentrations found in the crop corresponds fairly well with the quantity of dichlorprop found, when this was applied in similar quantities.

Spraying technique (Peder Odgaard)

Analyses of trace compounds (fluorescent dyes) have been carried out in connection with various experiments on the deposition of spray liquids on the plants, and with wind drift investigations.

Other analytical work in connection with experiments

Institute of Weed Control:

A field with ornamental green sprayed every year in the period 1979-83 (5 years) with atrazine, 5 kgs a.i./ha. Samples taken 30th November, 1984 and analyzed.
Content, mg/kg moist soil
0-10 cm: 0.12
10-20 cm: 0.03
20-30 cm: 0.015

Institute of Glasshouse Crops:

Through application on pot plants (growth regulation) daminozid has ended up in the circulating nutrient solution.
Possible concentration in theory: approx. 25 mg/l.
Concentration found (analysis): 0.8 mg/l.

Ordered analyses

In 13 cases soil samples have been examined for content of herbicides. The purpose has been partly to explain damage on crops and plantations, partly to estimate the risk to new-established cultures.

F. PUBLICATIONS

Adriansen, E. og P. Odgaard (1985): Residues of ancymidol cultivating *Aescynanthus* in recirculating nutrient solution. Tidsskr. Planteavl 89, 453-458.

Bagger, Ole (1985): Vejledning i bekæmpelse af sygdomme og skadedyr på kornafgrøder.Planteværnscentret 1-70.

Bagger, Ole (1985): Antal nødvendige svampesprøjtninger i markærter. Agrologisk Tidsskrift, Marken, 3, 40.

Bagger, Ole (1985): Vejledning i plantebeskyttelse. Bederoer, raps og ærter. Planteværnscentret 1-54.

Bagger, Ole (1985): Sygdomme og skadedyr på markært - biologi og bekæmpelse. Ref. af sprøjtemøder 1985, 26-28.

Begtrup, J. (1985): Carnation mottle virus demonstrated in *Begonia elatior* and *Begonia* x *Cheimantha* showing vein clearing, leaf curl and flower break (medforfatter) Acta Hort. 164, 33-39.

Begtrup, J. (1985): Prunus necrotic ringspot virus (PNRV) identified with ISEM directly from the trees. Tidsskr. Planteavl 89, 81-84.

Bromand, Bent (1985): Forsøg med bekæmpelse af jordboende skadedyr 1984. Dyrkernyt nr. 54, 11-13.

Bromand, Bent (1985): Pyrethroider - hvor og hvordan anvendes de mest hensigtsmæssigt. Referat af Sprøjtekursus i Landbrugsafgrøder 1985, 28-33.

Bromand, Bent (1985): Skadedyr på landbrugsafgrøder og frilandsgrønsager. 2. Danske Planteværnskonference. Sygdomme og skadedyr 2, 46.65.

Bromand, Bent (1985): bladlus i kor,. 2. Danske Planteværnskonference. Sygdomme og skadedyr 2, 100-106.

Bromand, Bent og F. Lind (1985): Nedsat dosering af pyrethroider. Agrologisk Tidsskrift, Marken, No. 6, 8-9.

Bromand, Bent (1985): Pyrethroider bør ikke få et dårligt ry. Landsbladet, No. 30, 28.

Bromand, Bent (1985): Bekæmpelse af skadedyr på landbrugsafgrøder og frilandsgrønsager. Forsøgsrapporter. Resultater af forsøg 1985. Institut for Pesticider. Statens Planteværnscenter, 1-120.

Buchwaldt, L. (1985): Bekæmpelsesstrategier for storknoldet knoldbægersvamp. (*Sclerotinia sclerotiorum*) i raps. 2. Danske Planteværnskonference. sygdomme og Skadedyr, 235-248.

Buchwaldt, L. (1985): Sygdomme i vinter- og vårraps. Vejledning i plantebeskyttelse. Bederoer, raps og ærter. 28-32.

Buchwaldt, L. (1985): Survival of sclerotial fungi in soil. 6th Scandinavian postgraduate course in plant pathology. "Soil Pathysystems", Gjarpenberg, 20-23.

Buchwaldt, L. (1985): Kålbrok kan blive aktuel med øget rapsdyrkning. Agrologisk Tidsskrift, Marken, 5, 35-38.

Buchwaldt, L. (1985): Prognoser for angreb af knoldbægersvamp i raps. Agrologisk

Tidsskrift, Marken, 6, 4-7.

Christensen, R. og R. T. Rubow (1985): Bekæmpelse af canadisk bakkestjerne. Skoven, No. 4, 102-103.

Elmholt, S. (1985): Pesticiders påvirkning af jordens mikroorganismer, pp. 42-45. I: *Hald. A.B. og J. Kjølholt* (1985): The Impact of Pesticides on the Wild Flora and Fauna in Agroecosystems. Miljøstyrelsens Center for Jordøkologi, Søborg.

Elmholt, S. (1985): The Composition of the Fungal Flora in a Field Soil Following Treatment with Ortho-Difolatan FW (captafol) or Tilt 250EC (propiconazol) in a Field Trial. Poster at FEMS-Symposium in Copenhagen, 4th-8th August and at seminar for researchers in plant pathology "Soil Pathosystems", Garpenberg, 21st-28th November.

Elmholt, S. og C.-O. Ottosen (1985): Landbruget som naturforvalter, Kaskelot 66, 27-37.

Elmholt, S. og V. Smedegaard-Petersen (1985): Virkninger af fungicidbehandling på jordens svampeflora. Ugeskrift for Jordbrug, 130, 376-382.

Engsbro, B. (1985): Rizomania. Vejledning i plantebeskyttelse i bederoer, raps og bælgplanter, 11-12.

Engsbro, B. (1985): Pas på halmen (*Cephalosporium* sp.). Dansk frøavl, 68, 196.

Engsbro, B. (1985): Ringrust i kartofler. Grønt Bad, No. 121.

Engbro, B. (1985): Rajgræsmosaik. Dansk Frøavl, 68, 436-37.

Engsbro, B. (1985): Byggulmosaik. Proc. Nordisk växtskyddskonference, Åbo, 89-90.

Engsbro, B. (1985): Byggulmosaik (medforfatter). Agrologisk Tidsskrift, Marken, No. 11, 36-39.

Engsbro, B. (1985): Virussygdomme i majs. Agrologisk Tidsskrift, Marken, No. 12, 31.

Engsbro, B. (1985): Ringrust i kartofler. Gartner Tidende, 101, 1595.

Engsbro, B. (1985): Meristemkultur, testning og formeringsteknik i kartofler. Undervisningsfilm (video) til brug i FAO.

Esbjerg, P. (1985): Orm i gulerødder, Gartner Tidende, 101, 629.

Esbjerg, P. (1985): Agerugler-knoporme. Gartner Tidende, 101, 747.

Esbjerg, P. (1985): Ærtevikleren. Gartner Tidende, 101, 869.

Esbjerg, P. (1985): Ugler i frøgræs. Dansk Frøavl, 68, 24.

Esbjerg, P. (1985): Olderborrer. Dansk Frøavl, 68, 282.

Esbjerg, P. (1985): Knoporme. Grønt Blad, 111.

Esbjerg. P. (1985): Knoporme (*Agrotis segetum*) - varslinger og skader i 1983 og 1984. 2. Danske Planteværnskonference. Sygdomme og Skadedyr, 249-260.

Hansen, L. Monrad (1985): Dårlig vækst i vårsæd kan skyldes havrenematoder, Landsbladet, 34, 32.

Hansen, L. Monrad (1985): Testing potato clones for resistance to *Globodera rostochiensis* (Rol) and *Globodera pallida* (Pa2 and Pa3) by root-ball screening.

EPPO Bulletin, 15, 193-198.

Hansen L. Monrad og J. Jakobsen (1985): Distribution of pathotypes of the potato cyst nematodes (*Globodera* spp.) in Danish gardens. Tidsskr. Planteavl, 89, 279-285.

Hansen, L. Monrad (1985): Registrering af bladlus i vårbyg - en vurdering af to års resultater. 2. Danske Planteværnskonference. Sygdomme og Skadedyr, 210-222.

Hansen, L. Monrad (1985): Pas på coloradobillerne. Gartner Tidende, 101, 809.

Hansen, L. Monrad (1985): Når den strenge vinter kommer igen. Flyfotografering i vinterafgrøderne. Planteavlsberetning for TKOL, 24.

Hansen, L. Stengård (1985): Biological control in Danish glasshouses - extent of use, application and success. EEC Experts' Group Meeting on Integrated and biological control in protected crops, Heraklion, Greece, 24th-26th April, 1985, 399-402.

Hansen, L. Stengård og J. Geyti (1985): Possibilities and limitations of the use of *Amblyseius mckenziei* Sch og Pr for biological control of thrips (*Thrips tabaci* Lind) on glasshouse crops of cucumber. EEC Expert' Group Meeting on Integrated and biological control in protected crops, Heraklion, Greece, 24th-26th April, 1985,145-150.

Hansen, L. Stengård (1985): Bioological control of glasshouse pests in Denmark: extent, economics and present research. Med. Fac. Landbouw. Rijksuniv., Gent 50/2a, 399-402.

Hansen, L. Stengård (1985): Plantepatologerne orienterer: biologisk bekæmpelse af trips i agurker. Gartner Tidende, 101, 1121.

Heide, M., J. Torp og V. Smedegaard-Petersen (1985): Resistensreaktioner i byg over for meldug. Ugeskrift for Jordbrug, 130, 465-468.

Heide, M. og V. Smedegaard-Petersen (1985): Common antigens between Barley and Barley powdery Mildew and their relation to resistance and susceptibility. Can. J. Pl. Path.

Heide, M., G.A. Strobel % B.M. Hess (1985): Biology *Rhizobium trifolii* bearing the hairy root plasmid. J. Gen. Microbiol.

Helweg, A. (1985): Transport, binding and nedbrydning af bekæmpelsesmidler i jord. Vejledning i bekæmpelse af sygdomme og skadedyr på kornafgrøder. Planteværnscentret, 65-69.

Helweg, A. (1985): Binding og nedbrydning af bekæmpelsesmidler i jord. Planteværn i Landbruget, LIK, 112-116.

Helweg, A. (1985): Påvirker bekæmpelsemidler de mikrobiologiske omsætninger i jord? 2. Danske Planteværnskonference. Sygdomme og Skadedyr, 287-302.

Helweg, A. (1985): Således forsvinder de kemiske bekæmpelsesmidler fra jorden. Landbonyt, 39, 641-644.

Helweg, A. (1985): Hvad sker der med de kemiske bekæmpelsesmidler. Haven, 85, 4, 204-207.

Helweg, A. (1985): Side effects caused by pesticide combination. Proc. FEMS-

symposium "Microbial communities in soil", 385-395. (*V. Jensen, A. Kjøller and L.H. Sørensen* eds.).

Helweg, A. (1985): Hvordan nedbrydes sprøjtemidlerne, og hvordan påvirker de livet i jorden. Landmandsalmanakken 1986.

Helweg, A. (1985): Kan brugen af kemiske plantebekskyttelsesmidler (pesticider) forårsage forurening af drænvand og grundvand. Kaskelot, 66, 18-26.

Helweg, A. (1985): Planlægning af et FEMS-symposium "Microbial Communities in soil" afholdt på Kollekolle 4th-8th August.

Helweg, A. (1985): Dicyandiamid (Didin, DCD) i jord. Sammendrag af litteratur vedrørende nedbrydning, binding, transport og effekt på mikroorganismer i jord. Rapport rekvireret af Miljøstyrelsen, 7 pp.

Helweg, A. (1985): Nitrapyrin (N. serve). Sammendrag af litteratur vedrørende nedbrydning, binding, transport og effekt på mikroorganismer i jord. Rapport rekvireret af Miljøstyrelsen, 8 pp.

Helweg, A. (1985): Indflydelse af DPX 6376 på ammonifikation og nitrifikation i jord. Undersøgelse rekvireret af Du Pont, 12 pp.

Helweg A. (1985): Indflydelse af DPX 6376 på respirationen i jord. Undersøgelse rekvireret af Du Pont, 5 pp.

Henriksen, Johs. Bak (1985): Mål og metoder ved bekæmpelse af kartoffelrodfiltsvamp (*Rhizoctonia solani*), Nordisk Jordbrugsforskning, 67, 300.

Henriksen, Johs. Bak (1985): Kartoffelavl i Pakistan. Kartoffelproduktion, 11, 1, 8-16.

Henriksen, Johs. Bak (1985): Når almindelig skurv angriber. Kartoffelproduktion, 11, 1, 15-17.

Henriksen, Johs. Bak (1985): Kemisk bekæmpelse af Phoma- og Fusariumråd. Kartoffelproduktion, 11, 3, 19-20.

Henriksen, Johs. Bak (1985): Phomaråd. Kartoffelproduktion, 11, 3, 24-25.

Henriksen, Johs. Bak (1985): Udvikling af Phoma- og Fusariumråd under lagring. Kartoffelproduktion 11, 4, 22-23.

Henriksen, Johs. Bak (1985): Spisekartofler til maj. Kartoffelproduktion, 11, 4, 22-23.

Henriksen, Johs. Bak (1985): Sygdomsrisiko ved tidlig optagning. Sajyka, 46, 35-36.

Henriksen, Johs. Bak (1985): Kartoffelrodfiltsvamp. Grønt Blad, 115.

Henriksen, Johs. Bak (1985): Phoma- og Fusariumråd. Grønt Blad, 116.

Henriksen, Johs. Bak(1985): Spisekartofler behandles ofte alt for brutalt. Landsbladet, 38.

Hobolth, Lars A. (1985): Skulpesvamp. Dansk Frøavl, 68, 122.

Hobolth, Lars A. (1985): Kålbrok. Dansk Frøavl, 68, 420-421.

Hobolth, Lars A. (1985): Sygdomme og skadedyrs indflydelse på prydplanters holdbarhed. Gartner Tidende, 101, 1584-1585.

Holm, Søren (1985): Planteværn i karrtoffelmarken. Hardi-Rama, 19-23,

Holm, Søren (1985): Kartoffelskimmel i læggekartofler. Sajyka, 46, 32-33.

Holm, Søren (1985): Fritfluer i græsser. Dansk Frøavl, 68, 160-161.

Holm, Søren (1985): Fritfluer i græsser. Grønt Blad, 123.

Holm, Søren (1985): Vejledning i plantebeskyttelse. Bederoer, raps og ærter. (Medforfatter). Statens Planteavlsforsøg. Planteværnscentret.

Holm, Søren og J. Simonsen (1985): Vejledning i bekæmpelse af sygdomme og skadedyr på kornafgrøde. (medforfattere). Statens Planteavlsforsøg. Planteværnscentret.

Holm, Søren (1985): Angreb af stankelben kan forudses. Agrologisk Tidsskrift, Marken, 30-31.

Holm, Søren (1985): Fritfluer i enårige græsmarken. Oversigt over Landsforsøgene 1985. 260-262.

Houmøller, M.S. og B. Welling (1985): Sortsblandinger af vinterbyg. 2. Danske Planteværnskonference. Sygdomme og skadedyr, 107-115.

Houmøller, M.S. og B. Welling (1985): Sortsblandinger af vinterbyg 1983/84. Nordisk Jordbrugsforskning, 67, 245.

Houmøller, M.S., K. Junker, H. Schulz, S. Stetter og B. Welling (1985): Varsling for meldug i byg. Ugeskrift f. Jordbrug, 130, 478-480.

Houmøller, M.S. (1985): Ny dansk virulensovervågning. Planteforædlingsnyt, 47, 12-13.

Houmøller, M.S. (1985): Sortsblanding af vinterbyg. Landsbladet, 27, 22.

Houmøller, M.S. (1985): Registrering af kornets bladsygdomme ved virulensovervågning. Agrologisk Tidsskrift, Marken, 11, 16-20.

Jakobsen, J. (1985): Nematoder i nåletræer. Skovbrugstidende, 2, 9-10.

Jakobsen, J. (1985): Kan insektparaistære nematoder anvendes til skadedyrsbekæmpelse. Gartner Tidende, 101, 223.

Jakobsen, J. og A. Nøhr Rasmussen (1985): Stængelnematoder. Gartner Tidende, 101, 1021.

Juhl, M. (1985): The effect of *Hirsutella heteroderae* on the multiplication of the beet cyst nematode on sugar beet. Tidsskr. Planteavl, 89, 475-480.

Junker, Kirsten og Bent J. Nielsen (1985): Resistens mod svampemidler. Landsbladet, 21, 52-55.

Junker, Kirsten og Bent J. Nielsen (1985): Kemiske bekæmpelsesmidler mod bygmeldug. Ugeskrift for Jordbrug, 130, 475-478.

Junker, Kirsten, medforfattere: *M.S. Houmøller, H. Schultz, S. Stetter og B. Welling* (1985): Varsling for meldug i byg. Ugeskrift for Jordbrug, 130, 478-480.

Junker, Kirsten og J. Chr. Nørgaard Knudsen (medforfattere) (1985): Hvordan kan virkningen af resistens i planer og fungicider aftage. Agrologisk Tidsskrift, Marken, 4, 30-34.

Junker, Kirsten (1985): Følsomhed over for ergosterolinhiberende fungicider hos bygmeldug. Växtskyddsrapporter, Jordbruk, 32, 14-15.

Junker, Kirsten (1985): Følsomhed hos bygmeldug over for ergosterolhæmmende fungicider. 2. Danske Planteværnskonference. Sygdomme og skadedyr, 187-196.

Jørgensen, H.A. (1985): Chrysanthemumsortråd. Gartner Tidende, 101, 101.

Jørgensen, H.A. (1985): *Theielaviopsis basicola* på prydplanter og køkkenurter. Gartner Tidende, 101, 331.

Jørgensen, H.A. (1985): Hindbærstængelsyge. Gartner tidende, 101, 995.

Jørgensen, H.A. (1985): Honningsvamp. Gartner Tidende, 101, 1157.

Jørgensen, H.A. (1985): Elmesyge. Gartner Tidende, 101, 1303.

Jørgensen, H.A. (1985): Meldug på frilandskulturer.Gartner Tidende, 101, 1560.

Jørgensen, Karen (1985): Hyacint gulbakteriose. Gartner Tidende, 101, 46.

Jørgensen, Karen (1985): Stenfrugttræernes bakteriekræft. Gartner Tidende, 101, 455.

Jørgensen, Karen (1985): Agurkens pletbakteriose. Gartner Tidende, 101, 841.

Jørgensen, Karen (1985): Bakteriesygdomme i kål. Gartner Tidende, 101, 1209.

Jørgensen, Karen (1985): Bladklædte galler. Gartner Tidende, 101, 1431.

Jørgensen, Karen (1985): Bakteriesygdomme i nellike. Gartner Tidende, 101, 1633.

Jørgensen, Karen m.fl. (1985): Bedre havebrugsplanter - nye, ensartede og sunde, 15 pp.

Jørgensen, Karen, H. Mygind, Niels Paludan og Arne Thomsen (1985): Frugttræer og -buske, hvor skadegørere er blevet fjernet. Grønt Blad, 128.

Jørgensen, Karen, H. Mygind, Niels Paludan og Arne Thomsen (1985): Prydplanter, hvor skadegørere er blevet fjernet. Grønt Blad, 129.

Jørgensen, Karen, H. Mygind, Niels Paludan og Arne Thomsen (1985): Fremtilling af sunde planter. Gartner Tidende, 101, 1514-1515.

Jørgensen, Karen, Jens Begtrup og Arne Thomsen (1985): Prunus necrotic ring spot virus identified with ISEM directly from the trees. Tidsskr. Planteavl, 89, 81-84.

Jørgensen, Lise Nistrup og J. Strøh (1985): Efterårsbekæmpelse af knækkefodsyge (*Pseudocercosporella herpotrichoides*) med Sportak 45 EC. 2. Danske Planteværnskonference. Sygdomme og skadedyr, 162-177.

Kirknel, Erik (1985): Pesticiders indvirken på næringsværdien i hvede og byg. 2. Danske Planteværnskonference.Sygdomme og skadedyr. 279-287.

Kirknel, Erik (1985): Correlation between residual analysis of 3 soil-incorporated insecticides and effect on the rove beetle *Aleochara bilineata* Gyll. tidsskr. Planteavl, 89, 4, 393-406.

Kirknel, Erik og T. Leth (1985): Næringsstofindholdet i kartofler efter sprøjtning med pesticider. NJF seminar: Fertilization of Potatos, 17th-18th June, Ålborg.

Kloster, Lilian, B. Welling og Bent Engsbro (1985): Byggulmosaikvirus i vinterbyg. Agrologisk Tidsskrift, Marken, 11, 36-39.

Kristensen, H., F. Nielsen og K. Ravn (1985): Planteværn i landbruget 1985.

Kristensen, H. Rønde (1985): A bibliography of Papers on Virus and Mykoplasma Diseases of deciduous Fruit Trees 1982-1985, 1-3.

Kristensen, H. Rønde (1985): List of fruit tree virus and mycoplasma disease. Intern. Comm. for Cooperat. in Fruit Tree Virus Research, 1-3.

Kristensen, H. Rønde (1985): Fremavl af havebrugsplanter. Grønt Blad, 96 (2. udgave).

Kristensen, H. Rønde (1985): Plantepatologerne orienterer - Status 1985. Gartner Tidende, 101, 1703.

Krogaard, H. (1985): Crude filtrate from *Helminthosporium teres* and its effect on protoplast, calli, germination seed, and leaves of *Hordeum vulgare* with respect to the net blotch disease. Physiologia Plantarum, 64, 26A.

Kudsk, Per (1985): Sprøjteteknik og additivers indflydelse på effekten af Avenge. 2. Danske Planteværnskonfrence. Ukrudt, 74-84.

Kudsk, Per (1985): "Faktorkorrigerede" doseringer - et alternativ til anbefalede doseringer? 2. Danske Platneværnskonference. Ukrudt, 217-234.

Kudsk, Per (1985). 8 rapporter over rekvireret arbejde.

Lind, F. og B. Bromand (1985): Nedsat dosering af pyrethroider. Agrologisk Tidsskrift, Marken, 6, 8-9.

Lind, F. (1985): Bekæmpelsesstrategier for skulpesnudebiller og skulpegalmyg i raps. 2. Danske Planteværnskonference. Sygdomme og skadedyr, 223-234.

Løschenkohl, Bent (1985): Bekæmpelse af kartoffelskimmel (*Phytophthora infestans*) på kartofler (*Solanum tuberosium*). 2. Danske Planteværnskonference. Sygdomme og skadedyr., 66-78.

Løschenkohl, Bent (1985): Bekæmpelse af svampesygdomme på kartofler, rodfrugter, industriplanter og grønsager på friland. Forsøgsrapporter. Resultater af forsøg 1985. Institut for Pesticider. Statens Planteværnscenter, 1-93.

Mygind, H. (1985): Gråskimmel (*Botrytis cinerea*) i tomatkulturer. Klima- og næringsstofundersøgelser i 8 gartnerier, 1979 og 1980. Tidsskr. Planteavl 89, 72. Beretning nr. S. 1766.

Mygind, H. (1985): Tyllose i væksthusagurk, en medvirkende årsag til for tidlig senescens. Tidsskr. Planteavl, 89, 196. Beretning nr. S. 1782.

Mygind, H. (1985): Rodfiltsvamp i væksthuskulturer. Gartner Tidende, 101, 159.

Mygind, H. (1985): Kransskimmel i tomat og urteagtige prydplanter. Gartner Tidende 101, 251.

Mygind, H. (1985): Svampeangreb i frøplanter og i stiklinger af træagtige planter. Gartner Tidende 101, 423.

Mygind, H. (1985): Æblemeldug. Gartner Tidende, 101, 593.

Mygind, H. (1985): Fusarioser i væksthuskulturer. Gartner Tidende, 101, 716-717.

Mygind, H. (1985): Meldug på stueplanter, Gartner Tidende, 101, 775.

Mygind, H. (1985): *Peronospora* på prydplanter. Gartner Tidende, 101, 897.

Mygind, H. (1985): Almindelig kartoffelskurv. Grønt Blad, 109.

Mygind, H. (1985): Kartoffelnetskurv. Grønt Blad, 110.

Nielsen, A. From (1985): Sædskifte. Sajyka, 46, 25-26.

Nielsen, A. From (1985): Kritiske perioder for insekt- og svampebekæmpelse i kornafgrøder. Agrologisk Tidsskrift, Marken, 3, 18-19.

Nielsen, A. From, Søren Holm og Ole Bagger (1985): Svampesygdomme og skadedyr på korn, græs og raps. Referat af sprøjtekursus i landbrugsafgrøder 1985. Landskontoret for Planteavl, 40-45.

Nielsen, A. From, Karen Ravn og Hans Kristensen (1985): Planteværn i Landbruget. Landbrugets Informationskontor, 126 pp.

Nielsen, Bent J. og H. Schulz (1985): Benzimidazole resistance in *Pseudocercosprella herpotrichoides* - monitering programme in Denmark. Eppo Bulletin, 15, 503-504.

Nielsen, Bent. J., L.N. Jørgensen og J. Simonsen (1985): Bekæmpelse af svampesygdomme på korn. Reports from experiments. Resultater fra forsøg 1985. Institut for Pesticider, Statens Planteværnscenter, 1-168.

Nielsen, Bent J. og H. Schulz (1985): Undersøgelser over resistens mod benzimidazoler hos knækkefodsyge (*Pseudocercosporella herpotrichoides*) i Danmark. Växtskyddsrapporter, Jordbruk, 32, 16-18.

Nielsen, Bent J. (1985): Bekæmpelse af svampesygdomme på korn. 2. Danske Planteværnskonference. Sygdomme og skadedyr, 79-99.

Nielsen, Bent. J og H. Schulz (1985): Efterårsbekæmpelse af knækkefodsyge (*Pseudocercosporella herpotrichoides*). 2. Danske Planteværnskonference. Sygdomme og skadedyr, 177-186.

Nielsen, Bent J. og H. Schulz (1985): Carbendazimresistens hos knækkefodsygesvampen (*Pseudocercosporella herpotrichoides*) i Danmark. 2. Danske Planteværnskonference. Sygdomme og skadedyr., 197-209.

Nielsen, Bent J. og O. Permin (1985): Virkning på meldug (*Erysiphe graminis*) og brunplet (*Septoria nodorum*) af propiconazol tilsat additiver. 2. Danske Planteværnskonference. Sygdomme og skadedyr, 261-270.

Nielsen, Bent J., medforfatter: *B. Welling* (1985): Sygdomme i vinterhvede II. Brunplet (*Septoria nodorum*). Tidsskr. Planteavl, 89, 73-79.

Nielsen, Bent J. (1985): Svampesygdommes resistens mod bekæmpelsesmidler. Sprøjtekursus, landbrugsafgrøder 1984, 21-22.

Nielsen, Ghita Cordsen (1985): Aktuel svampebesprøjtning, efterår. Agrologisk Tidsskrift, Marken, 10, 4 og 6.

Nielsen, Ghita Cordsen (1985): Prognose- og varslingssystemer - vigtige hjælpemidler for praksis. Agrologisk Tidsskrift, Marken, 11, 11-13.

Nielsen, Ghita Cordsen (1985): Aksfusariose - en upåagtet sygdom. Agrologisk Tidsskrift, Marken, 12, 21-22.

Nielsen, S.L. (1985): Mistspraying with low spray volumes and reduced amounts of pesticides against apple scab (*Venturia inaequalis*). Tidsskr. Planteavl, 89, 459-466.

Nielsen, S.L. (1985): An investigation of the occurrence of the black currant gall mite (*Cecidophyopsis ribis*, Westw.) in planting of black currants (*Ribes nigrum*). Tidsskr. Planteavl, 89, 487-490.

Nielsen, S.L. (1985): Forholdet mellem dosering og væskevolume ved sprøjtning mod æbleskurv. 2. Danske Planteværnskonference. Sygdomme og skadedyr,

271-278.
Nielsen, S.L. (1985): Bekæmpelse af solbærknopgalmider. Frugtavleren, 3, 62.
Nielsen, S.L. (1985): Solbærknopgalmider i planteskoler. Grønt Blad, 120.
Nielsen, S.L. (1985): Solbærknopgalmider i frugtavl, Grønt Blad, 122.
Nielsen, S.L. (1985): Solbærknopgalmider i private haver. Grønt Blad, 124.
Noyé, G. (1985): Sprøjtevejledning "Ukrudtsbekæmpelse i havebrug". Institut for Ukrudtsbekæmpelse, 42 pp.
Noyé, G. (1985): Nyanerkendte herbicider til havebrugsafgrøder. 2. Danske Planteværnskonference. Ukrudt. 11-18.
Noyé, G. (1985): Erstatningsmidler for Reglone og Grammoxone. 2. Danske Planteværnskonference. Ukrudt, 45-47.
Noyé, G. (1985): Resultater fra afprøvning af herbicider og vækstreguleringsmidler i havebrugskulturer og planteskoler, Planteværnscentret, Flakkebjerg, 409-545.
Noyé, G. (1985): Weed Control in currants and raspberries in Denmark. EEC Expert meeting. Dublin. Weed Control i vines and soft fruits, 4pp.
Noyé, G. and T. Rubow (1985): Sprøjtevejledning. "Ukrudtsbekæmpelse i Vedplantekulturer. Institut for Ukrudtsbekæmpelse.
Nøddegaard, E. (1985): Nyanerkendte fungicider og insekticider. 2. Danske Planteværnskonference. Sygdomme og skadedyr, 5-20.
Nøddegaard, E. (1985): Nyt om anerkendte plantebeskyttelsesmidler. Landbynyt, 39, 238-242.
Nøddegaard, E. (1985): Afprøvning af midler mod ukrudt, sygdomme og skadedyr. Gartner Tidende, 101, 1003.
Nøddegaard, E. (1985): Retningslinier for afprøvning af midler mod ukrudt, sygdomme og skadedyr. Ugeskrift for Jordbrug, 130, 1273.
Odgaard, P. (1985): Rester af dichlorprop i grøn ensileret byg. 2. Danske Planteværnskonference, Ukrudt, 313-328.
Paludan, N. (1985): virusinfektion i høst- og julebegonie. Gartner Tidende, 101, 19 og Grønt Blad, 113.
Paludan, N. (1985): Virussygdomme i rabarber. Gartner Tidende, 101, 191 og grønt Blad, 117.
Paludan, N. (1985): Løgmosaikvirus i løg. Gartner Tidende, 101, 292 og Grønt Blad, 118.
Paludan, N. (1985): Kålroemosaik i peberrod. Gartner Tidende 101, 398 og Grønt Blad, 119.
Paludan, N. (1985): Inactivation of viroids in Chrysanthemum by low-temperature treatment and meristem tip culture. Virus Diseases of Ornamental. Acta Hort., 164, 181-186.
Paludan, N. (1985): Carnation mottle virus demonstrated in *Begonia elatior* and *Begonia* x *Cheimantha* showing vein clearing., leaf curl and flower break. Virus Diseases of Ornamentals. Acta Hort., 164, 33-39.
Paludan, N. (1985): Inactivation of Kalanchoë latent virus strain 1 in *Kalanchoë* using heat treatment and meristem-tip culture. Tidsskr. Planteavl, 89, 191-195.

Paludan, N. (1985): Dasheenmosaikvirus i *Dieffenbachia*. Gartner Tidende, 101, 1053 og Grønt Blad, 132.

Paludan, N. (1985: Inactivation of tobacco mosaic virus in *Aeschynanthus hildebrandii* by means of heat treatment, chemotherapy and meristem-tip culture. Tidsskr. Planteavl, 89, 273-278.

Paludan, N. (1985): Virussygdomme i stauder. Gartner Tidende, 101, 1332-1333 og Grønt Blad, 133.

Paludan N. (1985): Virusrensning gennem meristemkultur. Vegetativ förøkning. Sveriges Landbruksuniversitet, Konsulentavdelningens rapporter. Trädgård, 290, 28-32.

Paludan, N. (1985): Virus i spinat. Gartner Tidende, 101, 1371 og Grønt Blad, 136.

Paludan, N. (1985): Bedre havebrugsplanter - nye ensartede og sunde (medforfatter). Statens Planteavlsforsøg, Pjece, 15 pp.

Paludan, N. (1985): Fremstilling af sunde planter (medforfatter). Gartner Tidende, 101, 1514-15.

Paludan, N. (1985): Virussygdomme i potteplanter. Gartner Tidende, 101, 1660-61.

Paludan, N. (1985): Spread of viruses by recirculated nutrient solutions in soilless cultures. Tidsskr. Planteavl 89, 467-474.

Permin, O., P. Odgaard og E. Kirknel (1985): Afsætning af sprøjtevæske i platnebestanden. 2. Danske Planteværnskonference. Ukrudt, 99-117.

Permin, O. (1985): Døgnsprøjtninger med midler til stråforkortning i vårbyg. 2. Danske Planteværnskonference, Ukrudt, 173-192.

Permin, O. (1985): Production of rhizomes from *Elymus repens* (L) Gould growing in competition with barley and other agricultural crops. Proceedings International symposium on the longterm control of *Elymus (Agropyron) repens.* Nov. 1985, 26-39.

Permin, O: (1985): Sprøjtemetoder til forbedring af Tilts biologiske effekt. Rapport for rekvireret arbejde 1985, 1-20. Firma: Ciba-Geigy A/S, Lyngbyvej 172, 2100 København Ø.

Permin, O. (1985): Væskemængdens indflydelse på effekten af Avenge mod flyvehavre i vårbyg. Rapport for rekvirert arbejde 1985, 1-7. Firma: Nordisk Alkali Biokemi A/S, Islands Brygge 91, 2300 København S.

Permin, O. (1985): Fusilades langtidsvirkning over for alm. kvik. Halvvejsrapport for rekvireret arbejde 1985. Firma: ICI Danmark A/S, Islands Brygge 41, 2300 København S.

Petersen, E. Juhl (1985): Plantebeskyttelsesmidler anerkendt til bekæmpelse af plantesygdomme, skadedyr og ukrudt, til nedvisning af frøafgrøder og kartoffeltop samt til vækstregulering, 49-73.

Petersen, E. Juhl (1985): Nyanerkendte herbicider og vækstreguleringsmidler. 2. Danske Planteværnskonference. Ukrudt, 1-10.

Petersen, E. Juhl og P. Elbæk Jensen (1985): Resultater fra afprøvning 1985.

Statens Planteavlsforsøg. Planteværnscentret, Flakkebjerg, bind 1 og 2, 408 pp.

Rasmussen, A. Nøhr (1985): Afprøvning af plantebeskyttelsesmidler i buskfrugt, gartneri- og planteskolekulturer. 2. Danske Planteværnskonference. Sygdomme og skadedyr, 21-33.

Rasmussen, A. Nøhr og J. Reitzel (1985): Løgmider. Gartner Tidende, 101, 369.

Rasmussen, A. Nøhr og J. Jakobsen (1985): Nematoder på gulerødder. Gartner Tidende, 101, 523.

Rasmussen, A. Nøhr og J. Jakobsen (1985): Stængelnematoder. Gartner Tidende, 101, 1021.

Rasmussen, A. Nøhr (1985): Afprøvning af plantebeskyttelsesmidler mod skjoldlud (*Saisetta coffaea*) og uldlus (*Pseudococcus adomidum*) på væksthuskulturer. Konferenceberetning. Nordisk Planteværnskonference, Åbo, 70-75.

Rasmussen, A. Nøhr (1985): Afprøvning af fungicider mod gråskimmel (*Botrytis cinerea*) på jordbær. Konferenceberetning. Nordisk Planteværnskonference, Åbo, 57-69.

Rasmussen, A. Nøhr (1985): Nyt vedr. plantebeskyttelsesmidler. Beretning fra Dansk Erhvervsgartnerforenings plantebeskyttelsesdag, 25-33.

Rasmussen, A. Nøhr (1985): Bekæmpelse af skadedyr og svampesygdomme i buskfrugt, gartneri- og planteskolekulturer. Report from experiments. Results of experiments 1985. Institut for Pesticider, Statens Planteværnscenter, 103 pp.

Ravn, K. (1985): Bekæmpelse af ukrudt i engsvingel. De samvirkende danske Frøavlerforeninger. Temahæfte, 16, 412-415.

Ravn, K. (1985): Ukrudtsbekæmpelse i kartofler. Sajyka, 46, 29-30.

Ravn, K. (1985): Ukrudtsbekæmpelse i korn. Vejledning i bekæmpelse af sygdomme og skadedyr på kornafgrøder. Statens Planteavlsforsøg 1985.

Ravn, K. (1985): Vintersæd som ukrudt. 2. Danske Planteværnskonference. Ukrudt, 291-298.

Ravn, K., H. Kristensen og F. Nielsen (1985): Planteværn i landbruget 1985.

Ravn, K. (1985): Kemisk bekæmpelse af ukrudt i vintersæd. Agrologisk Tidsskrift, Marken, 3, 8-10.

Ravn, K. (1985): Sprøjtevejledning. Ukrudtsbekæmpelse i landbrug 1985. Institut for Ukrudsbekæmpelse.

Ravn, K. (1985): Ukrudtsbekæmpelse i frømarker. Dæhnfeldt-avleren, 3-4, 3-6.

Ravn, K. (1985): Vejledning i plantebeskyttelse i bederoer, rasp og ærter. Statens Planteavlsforsøg.

Ravn, K. (1985): Bekæmpelse af ukrudt i vitnersæd, frøgræs og ærter og bekæmpelse af kvik. Referat fra sprøjtekursus i landbrugsafgrøder 1985, 34-60.

Ravn, K. (1985): Bekæmpelse af ukrudt i bederoer, kartofler, ærter og raps. Landbonyt, 39, 275-285.

Ravn, K. (1985): Bekæmpelse af ukrudt i vintersæd om efteråret. Agrologisk Tidsskrift, Marken, 9, 8-11.

Ravn, K. (1985): Bekæmpelse af ukrudt i vintersæd og vinterraps om efteråret. landbonyt, 39, 525-534.

Ravn, K. (1985): Bekæmpelse af ukrudt i raps og ærter. Landmandens Almanak 1986.

Reitzel, J. (1985): Bladlus på bederoer. Landbonyt, 39, 341.

Reitzel, J. (1985): Bladlus på salat, Gartner Tidende, 101, 1397.

Reitzel, J. (1985): Cyclamenmiden (*Steneotarsonemus pallidus*) på jordbær. Gartner Tidende, 101, 1098.

Reitzel, J. (1985): Skudsspidsmider på agurker, Gartner Tidende, 101, 689.

Reitzel, J. og A. Nøhr Rasmusse (1985): Løgmider. Gartner Tidende, 101, 369.

Reitzel, J. (1985): Bladlus på spinat. Dansk Frøavl, 68, 318.

Reitzel, J. (1985): Bladlus på frøgræs og korn. Dansk Frøavl, 68, 139.

Reitzel, J. (1985): Kuglemider i frøgræs. Dansk Frøavl, 68, 48.

Rubow, T. (1985): Canadisk bakkestjerne: Udbredelse, betydning og bekæmpelsesmuligheder. 2. Danske Planteværnskonference. Ukrudt, 299-312.

Røyrvik, J. (1985): Nedbrydning af chlorsulfuron og DPX T6376 på friland. 2. Danske Planteværnskonference. Ukrudt., 258-269.

Samsøe-Petersen, L. (1985): Testmetoder til undersøgelse af pesticiders virkning på rovbillen *aleochara bilineata*, rapport til Miljøstyrelsen, Planteværnscentret, Zoologisk Afdeling, 37 pp.

Samsøe-Petersen, L. (1985): Pesticiders virkning på skadedyrs naturlige fjender. Växtskyddsrapporter, Jordbruk, 32, 147-154.

Samsøe-Petersen, L. (1985): Laboratory tests to investigate the effect of pesticides on two beneficial arthropods : a predatory mite (*phytoseiulus persimilis*). Pesticide Sci., 16, 321-331.

Samsøe-Petersen, L. (medforfatter), *Hassan et al.* (1985): Standard methods to test the sideeffect of pesticides on natural enemies of insects and mites developed by the IOBC/WPRS Working Group 'Pesticides and Beneficial Organisms'. EPPO Bulletin , 15, 228-29 and 234.

Schadegg, E. og E. Juhl Petersen (1985): Plantebeskyttelsemidler anerkendt til bekæmpelse af plantesygdomme, skadedyr og ukrudt til nedvisning af frøafgrøder og kartoffeltop samt til vækstregulering, 1-82.

Schadegg, E. (1985): Efterafprøvning af fungicider mod æbleskurv (*Venturia inaequalis*) 1982-1984. (Evaluation of three years' Tests for Control of Applescab with different Fungicides). 2. Danske Planteværnskonference. Sygdomme og skadedyr, 34-45.

Schadegg, E. (1985): Bekæmpelse af skadedyr og svampesygdomme i frugtavl. Forsøgsrapporter. Resultater af forsøg 1985. Institut for Pesticider. Statens Planteværnscenter, 1-150.

Schulz, H. og B.J. Nielsen (1985): Efterårsbekæmpelse af knækkefodsyge (*Pseudocercosporella herpotrichoides*). 2. Danske Planteværnskonference. Sygdomme og skadedyr, 177-186.

Schulz, H. og B.J. Nielsen (1985): Carbendazimresistens hos knækkefodsyge

(*Pseudocercosporella herpotrichoides*) i Danmark. 2. Danske Planteævnrskonference. Sygdomme og sakdedyr, 197-209.

Schulz, H. og G. Friis (1985): Anvendelse af meteorologiske data i varsling for knækkefodsyge. Växtskyddsnotiser, 49, 61.

Schulz, H. og B.J. Nielsen (1985): Benzimidazole resistance in *Pseudocercosporella herpotrichoides* - monitoring programme in Denmark. EPPO Bulletin, 15, 503-504.

Schulz, H. (1985): Ærtesygdomme. Statens Planteavlsmøde, 47-48.

Schulz, H. m.fl. (1985): Vejledning i plantebeskyttelse, bederoer, raps og ærter, 54 pp.

Schulz, H. (1985): Bekæmpelse af knækkefodsyge om efteråret eller omforåret. Agrologisk Tidsskrift, Marken, 4, 44-46.

Schulz, H. (1985): Kløverens knoldbægersvamp. Dansk Frøavl, 68, 138.

Schulz, H. (1985): Ærteskimmel. Dansk Frøavl, 68, 451.

Simonsen, J. (1985): Bekæmpelse af svampesygdomme på korn. Afprøvning (medforfatter) *(Bent Nielsen et al.)*.

Stetter, Sten (1985): Vejledning i plantebeskyttelse pr. computer. Tolvmandsbladet, 4, 133-136.

Thomsen, A. (1985): Rattlevirus hos hyacinth. Gartner Tidende, 101, 129.

Thomsen, A. (1985): Augustsyge hos tulipaner. Gartner Tidende, 101, 488.

Thomsen, A. (1985): Grønne kronblade hos jordbær. Gartner Tidende, 101, 655.

Thomsen, A. (1985): Jordbårne viroser hos træagtige planter i Danmark. Gartner tidende, 101, 1241.

Thomsen, A. (1985): Spredningsrisici for viroser i frugttræer. Gartner Tidende, 101, 1476-1477.

Thomsen, A. (1985): Fremstilling af sunde planter. Gartner Tidende, 101, 1514-1515.

Thomsen, A. (1985): Jordprøver til virusundersøgelse. Gartner Tidende, 101, 1703.

Thomsen, A. (1985): Frugttræer og frugtbuske, hvor skadegørere er blevet fjernet. Grønt Blad, 128.

Thomsen, A. (1985): Prydplanter, hvor skadegørere er blevet fjernet. Grønt Blad, 129.

Thomsen, A. (1985): Bedre havebrugsplanter (medforfatter). PjeceJun, 15 pp.

Thomsen, A. og P. Krogstrup (1985): Use of meristem-tip culture in vitro for elimination of Raspberry Ringspot virus (RRSV) in red currant. Håndbog. A. Schäfer-Menuhr (editor). In vitro techniques. For the commission of European Communities, 79-83.

Thomsen, A. (1985): Jordbårne viroser hos træagtige planter i Danmark. Proc. Nordisk Växtskyddskonferens, 87-88.

Thomsen, A. (1985): Prunus nectotic rinspot virus (PNRV) identified with ISEM directly from the trees. Report, 1768. Tidsskr. Planteavl, 89, 81-84.

Thonke, K.E. (1985): Orienterende forsøg på vækstregulering af raps til CCM

med Terpal C og Cerone. 2. Danske Planteværnskonference. Ukrudt. 192-202.

Thonke, K.E. og P. Kudsk (1985): Klimafaktorernes indflydelse på effekten af Gallant (Dowco 453 EE) over for alm kvik. 2. Danske Planteværnskonference. Ukrudt. 235-244.

Thonke, K.E. (1985): Generelt om marksprøjtning. Agrologisk Tidsskrift, Marken, 5, 4-7.

Vester, J. (1985): Flammer mod Ukrudt, Grønt Miljø, 4, 7-9.

Welling, Boldt (1985): Meldug på korn. Erfaringer fra 1984. - Hvordan i 1985? Referat fra sprøjtekursus i Landbrugsafgrøder 1985, 18-21.

Welling, Boldt (1985): Sneskimmel i frøgræs. Dansk Frøavl, 68, 14.

Welling, Boldt (1985): Meldug hos frøgræs. *Dansk Frøavl, 68, 180.*

Welling, Boldt (1985): Meldrøjer. Dansk Frøavl, 68, 268.

Welling, Boldt (1985): *Mastigosporium* bladplet. Dansk Frøavl, 68, 301.

Welling, Boldt (1985): Rød tråd *hos græs. Dansk Frøavl, 68, 330-331.'*

Welling, Boldt (1985): Rust hos engrapgræs. Dansk Frøavl, 68, 366-367.

Welling, Boldt (1985): Netnekrose en bladsygdom hos græs. Dansk Frøavl, 68, 397.

Welling, Boldt (1985): Kronrust på almindelig rajgræs. Dansk Frøavl, 68, 468-469.

Welling, Boldt (1985): Rust hos engrapgræs. Grønt Blad, 126.

Welling, Boldt (1985): Meldrøjer. Grønt Blad, 127.

Welling, Boldt (1985): Rød tråd hos græs. Grønt Blad, 130.

Welling, Boldt (1985): *Mastigosporium* bladplet. Grønt Blad, 131.

Welling, Boldt (1985): Rød øjeplet på rapgræs. Grønt Blad, 134.

Welling, Boldt (1985): Kronrust hos alm. rajgræs. Grønt Blad, 135.

Østergård, S.P. og Johs. Bak Henriksen (1985): Kvalitetsfejl hos spisekartofler i detailhandelen og virkning af oparbejdning og forvarmning på beskadigelsesgraden. Beretning, 1769. Tidsskr. Planteavl, 89, 85-90.