4. Es wird angenommen, daß die Befallsunterschiede noch deutlicher werden, wenn das für die Resistenzzüchtung unter weit strengerem Maßstab selektierte Material geprüft wird.

5. Durch Wurzeluntersuchungen konnten bei diesem Material keine Zusammenhänge zwischen Befall und Ausbildung des Wurzelsystems nachgewiesen werden.

Summary

Title of the paper: Investigations into individual differences in the attack of needle cast disease in Pinus *sylvestris* L. —

1. In pine stands badly damaged by needle cast disease, trees which were severely attacked and others which were only slightly attacked by the fungus (positive and negative) were selected. From these trees grafts were made in the greenhouse.

2. The grafts were artificially infected in an inoculation fiqld, and the degree of the attack by the fungus was tested in the summers of 1955 and 1956.

3. In both years there were significant differences in the degree of attack on "negative" and "positive" pines.

4. It must be assumed that the differences in the attack will be clearer if the material selected to a higher standard and used for resistance improvement, is tested in this way.

5. Investigations of the roots of this material did not reveal any connection between the evidence of the disease and root development.

Résumé

Titre de l'article: Recherches sur la *variabilité* individuelle en ce qui concerne Lophodermium pinastri *Schrader chez* Pinus *sylvestris* L. —

1. Dans les peuplements de pins sévèrement endommagés par Lophodermium pinastri, on a sélectionné des individus fortement attaques, d'autres peu attaqués (sélection negative et positive). Ces individus furent multiplies par greffe en serre.

2. Les plants greffes furent infectés artificiellement, et, en été 1955 et 1956, on a observé les attaques de la maladie sur ces arbres.

3. Au cours de ces deux annees on a pu constater des differences entre les pins «négatifs» et «positifs».

4. On admet que ces differences augmenteront lorsque les pins sélectionnés plus précisément pour leur résistance seront l'objet de mesures.

5. On n'a pu constater aucune corrélation entre l'attaque et le développement du système radiculaire de ces pins.

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Elm-breeding in the Netherlands

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1. Background and history

Native elms in the Netherlands are *Ulmus* glabra HUDS., some form(s) of U. carpinifolia GLED., and possibly U. laevis PALL. The first one is found in a few forest-associations in the extreme south and east of the country. The second one occurs in several forest-types, but mainly in the *Ulmetum* suberosae, which covers only about 50 ha on rich sandy soils along the large rivers and along the dunes. The major part of this vegetation is coppice, only about 5 ha bear high forest (comm. H. DOING KRAFT). U. *laevis* is a rare tree in the Netherlands and so none of the native species is of much economic value.

However, elms were extensively planted in Holland and even so the clones used did not belong to a wild species. The vast majority of the trees, more than 99%, belonged to one clone, X U. hollandica MILL. belgica (BURGSD.) R., a hybrid between U. glabra HUDS. and U. carpinifolia GLED., being a product of selection by nurserymen in earlier centuries. (In Holland, the clone is called "Hollandse iep", i. e. "Dutch elrn"; in other countries, "Dutch elm" is X U. hollandica MILL. *major* (SM.) R., from which up till now no more than one tree has been found in Holland.) Here and there, too, the Huntingdon elrn X U. hollandica MILL. vegeta (LOUD.) R. was planted, and before the appearance of the elrn disease, U. carpinifolia GL. *sarniensis* (LOUD.) R. was planted in increasing numbers because of its outstanding wind-resistance.

The elrn was a characteristic tree in the western and northern parts of the country. It was seldom seen in forests but it was planted in great numbers along roads, around farms and villages and in towns. In 1930, there were 1,230,000 elms still left (BURGER 1938). The relative importance of this figure can be measured from the number of poplars estimated by HOUTZAGERS in 1937, i. e. 1,900,000, half of which were planted in forests. This clearly shows that outside the forest, at that time, the elrn was more important than the poplar.

There were good reasons for planting so many elms. Partly they were grown for their timber, since elrn grows very fast, giving timber of a good quality. For good veneer logs, up to and more than one thousand guilders per cubic meter is paid. — Perhaps a still more important reason is the trees' function as a shelter against wind in the windy coastal provinces, making the country more inhabitable. In fact, elrn can resist more wind, especially seawincl, than any other tree-species in the region. Salt is carried

[1]) This paper appears also as "Korte Mededeling nr. 29 van het Bosbouwproefstation T.N.O." and as "Mededeling nr. 16 van het Phytopath. Lab. Willie Commelin Scholten".

Fig. 1. — *U. hollandica belgica* along a road in the province of Friesland. Note that the trees have grown sideways owing to the force of the wind.

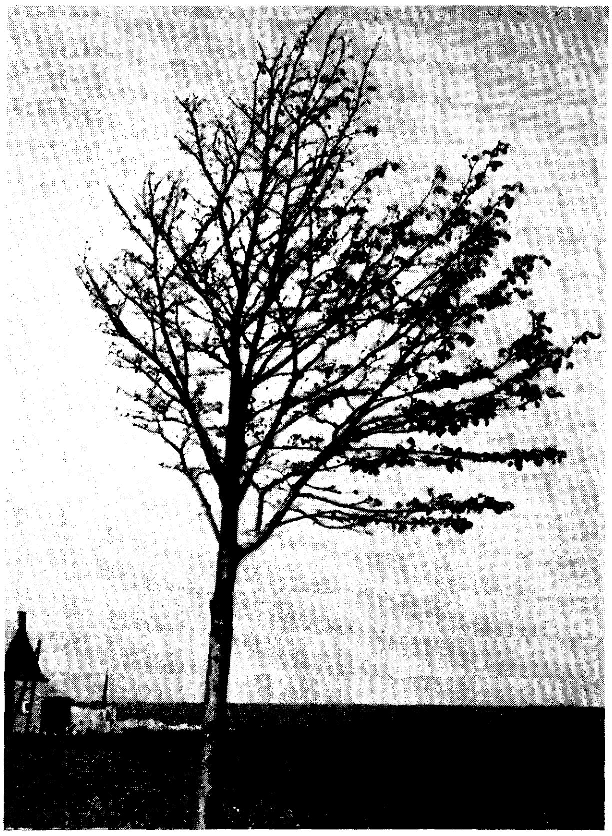

Fig. 2. — Influence of storm of May, 18th, 1955 on lime. Leaves and shoots at the weather-side have been killed. (15 km inland.)

inland by storms, which mainly in spring may burn young leaves and shoots. The elm can stand it better than most other tree-species. It can even stand some salt in the soil (van 't Westeinde 1953). These reasons make up for the fact that it was the only tree planted in some areas. The indispensability of elm in this respect is shown lately by the difficulties encountered in efforts to replant the treeless areas, flooded in 1953, using other species than elm. — Another reason for planting *U. hollandica belgica* was its attractive shape: it is a tree of great beauty, valued both in the country and in towns (the Amsterdam canals!).

Since 1918 these plantations have been afflicted by the elm disease, a "new" disease, probably introduced from Asia. People realised that in the coastal provinces, elm cannot be replaced by other species, and therefore decided to select or breed a new and resistant form. For this purpose the Elm-disease Committee was founded in 1930.

Although the work was started in 1928, it can hardly be regarded as an early example of forest tree breeding. As an avenue-tree, the elm stood in the borderland of forestry and horticulture; since experience with breeding was larger in horticulture as compared with forestry, the work was completely taken up from the horticultural side. This trend was supported by the fact that over nearly the whole country only one clone was planted, which minimized possibilities to profit from natural selection, to work with plus-trees, etc.

In 1928 the collecting of the vast diversity of cultivated clones was started. Wild American and Asian elm species were brought together from botanical gardens, while about 10,000 seedlings of European elms were procured from commercial nurseries (thus without known origin). In this plant material selection took place, primarily for resistance to the elm disease. In 1937 hybridizing between the selected trees was started. For particulars of the history see Went (1938 and 1953). The F_2 is being made now. The purpose is to win one or more new, better clones. For an avenue-tree, the cost of vegetative propagation (layering, grafting, rooting from softwood cuttings) is not prohibitive, so there is no need to aim for seed-orchards.

2. Aims of breeding

a. Resistance to the elm disease.
b. Resistance to the coral spot disease.
c. Resistance to frost.
d. Resistance to wind.
e. Fast growth.
f. Good form, decorative leaves.
g. No epicormic shoots and suckers.
h. Valuable timber.

If any of these qualities were lacking, the usefulness of the tree would be small or nil. It would therefore be wrong to call one quality more *important* than any other one; but it may be more *rare* in the available material!

ad 2a. Resistance to the elm disease. This well-known wilting disease is caused by the spores of the fungus *Ophiostoma ulmi* (Buism.) Nannf., which live and spread in the vessels. These get plugged, so that the crown of the tree wilts and dies. The disease is carried by different species of beetles; in Holland two *Scolytus*-species act as such. For further particulars the reader is referred to the textbooks.

In selection for resistance, no use is made of the beetles, but a spore-suspension is brought directly into the vessels, e. g. with a syringe. This very nearly gives the same results as infection by beetles (Fransen and Buisman [1935], Buisman [1936]). — Some further aspects of selection for resistance to the elm disease are discussed sub *2e* and in chapter *3*.

Disease-resistance was very rare in the beginning, making it necessary to be content either with half-resistant trees showing desirable characters for the rest, or with fully resistant trees that did not come up to expectations in other respects. Examples of the first group are *U. hollandica vegeta* and several selections from the 10,000 seedlings of European elms. In the second group, e. g. *U. wallichiana* and *U. pumila* are fully resistant to the elm disease, but do not satisfy the requirements sub *b*, *c* and *e*, respectively *e*, *f* and *h*.

Something must be said about the English name of the disease. Though probably the disease comes from Asia and though in Europe it occurred first in northern France (WESTENBERG 1932), it is commonly known as "Dutch elm disease". Apart from being illogical, the name inclines people to think it relates to a disease of the Dutch elm. This can only add to the confusion regarding the name "Dutch elm", since many Americans now believe it is the Dutch elm that dies in their streets.

Some textbooks have introduced the name "*Ceratostomella* disease of elms". This seems to be no improvement, since many mycologists reject "*Ceratostomella ulmi*" and use "*Ophiostoma ulmi*" instead (NANNFELD 1934); lately even the name "*Ceratocystis*" has been rediscovered (HUNT 1956). "Elm wilt" sounds well, but may be too vague, since *Verticillium* and *Dothiorella* may also produce wilt in elm. Thus, if our English speaking colleagues do not think it suffices to speak about "*the* elm disease", the name "*Graphium* disease of elms" (WESTENBERG 1932) seems to be the best one at the moment. The name is short, and probably "*Graphium*" will stay valid for the imperfect form of the fungus, which in the biology of the disease is more important than the perfect stage.

ad 2b. Resistance to the coral spot disease, caused by *Nectria cinnabarina* (TODE) FR. This fungus mostly acts as a saprophyte, but some strains can be harmful as wound-parasites on many trees. In elms, *Ulmus pumila* and *U. wallichiana* are particularly susceptible to attack through wounds. The parasite is still more dangerous if even healthy, undamaged trees are attacked. That is what happens to the Christine Buisman-elm, the first selection that was released to trade by the Elm-disease Committee (fig. 3). For this reason, the clone is used no more in the Netherlands.

Also some new hybrids are highly susceptible; others are resistant. To prevent a second disappointment with too susceptible a clone, the biology of the disease is studied with the aim of developing an inoculation-method that is more natural than wound-inoculation. Up till now, only spontaneous infection (the fungus is present everywhere in the nursery) and wound inoculations are used to obtain a picture of the susceptibility of the tree.

It has been found that especially some southern types are very susceptible: *U. wallichiana* from the Himalaya, and Chr. Buisman from Madrid. It is noteworthy that in lower latitudes the last mentioned clone is not attacked by the fungus, although both are present: in Italy and in the U.S.A. the tree remains healthy.

ad 2c. Resistance to frost. Nearly all material with which breeding was started originates from areas with a milder climate (England, France, Spain, etc.). Therefore it is not surprising that some frost-susceptible types can be found among them. Frost-damage occurs in several ways and degrees. In milder forms, it may give rise to formation of undesirable epicormics, or perhaps the quality of the timber may be afflicted; therefore it is not easy to state which degree of susceptibility can be tolerated in practice.

No artificial freezing is applied. Selection is carried out after a cold winter such as 1955/56. Furthermore it is being attempted to introduce elms suitable as parent-trees from countries with a colder climate.

ad 2d. Resistance to wind. It is therefore sensible to breed for this property since it is very important for practice (see *chapter 1*), and since not all elms exhibit it in the same degree. *Ulmus carpinifolia sarniensis* and *U. glabra exoniensis* are particularly resistant; for this reason, these clones have recently been incorporated again in the breeding-program.

Up till now, selection in young seedlings has been done owing to the lack of a good method. Grafts from the better clones are planted out in field-trials, where among other things observations are made on their wind-resistance.

ad 2e. Fast growth. For most purposes, fast growth of elm is highly desirable. A difficulty is caused by the fact that trees with faster growth often show a higher susceptibility to the elm disease than trees that grow more slowly. Fortunately, the correlation is far from absolute, and we can therefore reassure EKLUNDH-EHRENBERG (1954) and others, who fear that selection for resistance to elm disease cannot be anything else but selection for slow growth. Several clones which are under investigation show both a high growthrate and high resistance.

Among seedlings in their young stage, selection for fast growth is not carried out too severely: moderate growth in youth may well be followed by fast growth afterwards, whereas fast growth in youth may decline later on. More value is attached to the growthrate of the grafts, once the seedling seemed good enough to be propagated and tried on a larger

Fig. 3. — Crown of the elm "C. Buisman", attacked by the coral spot disease. Large branches have been killed. The branch on the right hand has been killed in the previous year.

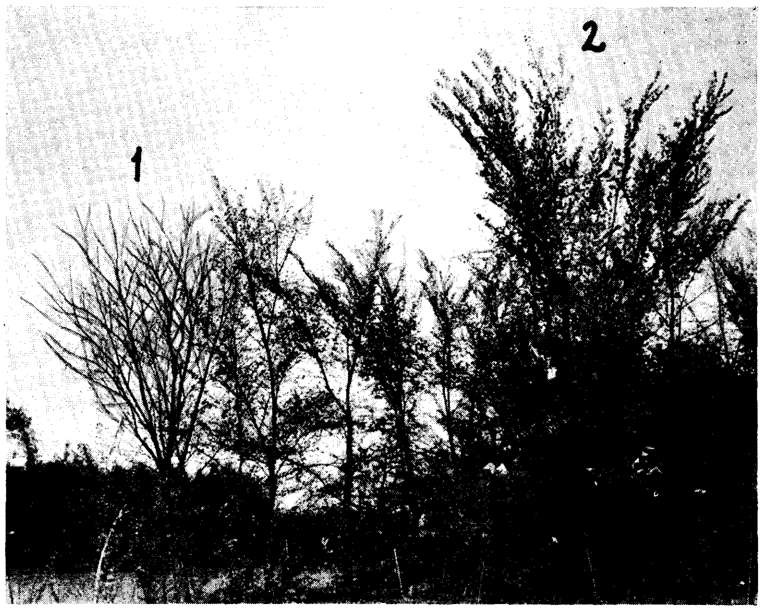

Fig. 4. — Heterosis. Tree 1 is *U. wallichiana,* mother of 2: *U. wallichiana × glabra exoniensis.* This one is exactly 1.5 times higher than its mother. Both trees are about 18 years old. — The father, the "Exeter elm", is an ornamental tree that never reaches high growth. *(U. wallichiana* is bare since it is killed by frost, 1956.)

scale. But to a lesser degree, essentially the same question arises here, whether fast growth in a graft of a few years old will be continued, throughout the years. In some known cases it does not: *Ulmus hollandica vegeta* in comparison with *U. hollandica belgica.* For new clones, only long-term field trials can give the answer.

Obvious examples of heterosis have been observed (fig. 4). Unfortunately it cannot be predicted whether one or another combination of parents will give heterotic seedlings. Even reciprocal crossings sometimes show significant differences in growthrate. Therefore it is necessary to try out a great number of combinations to find the best ones.

ad 2f. Good shape, decorative leaves. The tree must have a straight bole to give a good piece of timber; but moreover, a tree that will be planted extensively in towns and that will dominate vast landscapes in the country must be of a beautiful appearance too. Since the shape of *U. hollandica belgica* is a particularly loved one, attempts are made to win back something similar by renewed crossing with this clone, and by trying to introduce new specimens of the similar *glabra*-type, which can be incorporated in the breeding program.

The decorative value of a tree is partly determined by its leaves, so these must be passable. They may not regularly be disfigured by leaf spots, or be shed early in the season. Large leaves are preferred. Since small leaved elms often show a somewhat higher resistance to the elm disease than large leaved trees, care must be taken to avoid breeding extremely small leaved types. This is made easier by the fact that these types often exhibit other undesirable characters of growth and shape too.

ad 2g. No epicormic shoots and suckers. Epicormic shoots make the timber unsuitable for veneering purposes, and reduce the value of the tree for avenue planting. Suckers cannot be tolerated in town, and are undesirable in the country.

There is a great variation in elms as to these properties. They seem to be suppressed in the progeny of *glabra*-forms. This is one more reason why it is advisable to get new *glabra*-types suitable as parent-trees.

ad 2h. Valuable timber. Nowadays, logs suitable for veneering are priced five to ten times higher than others, so it seems worthwhile to select for a good quality of timber. Unfortunately, we have not yet arrived at a method to determine on relatively young trees the quality of timber, let alone its suitability for veneer. Since differences do exist (Zieger 1952), this is a real gap in the selection.

3. Juvenile resistance to the elm disease

Two year old seedlings are not yet susceptible to the elm disease; three year old seedlings will show symptoms of the disease upon inoculation only if extremely well grown. In an experiment in a group of three year old plants not one single individual took the disease, although they were inoculated according to the very drastic method recommended by Caroselli and Feldman (1951) for young seedlings.

When a group of seedlings is inoculated year after year, every time additional individuals take the disease *(fig. 5).* This can be explained only by assuming that susceptibility increases as the plants grow older, until at last a more or less stable level of resistance is reached.

In several cases, also in a single clone, a certain increase in susceptibility has been observed. E. g. in the Buisman elm, from 1932 up till 1939, 1838 inoculations were performed on the seedling and on grafts of different ages; only in 36, or 2% of the cases, symptoms of the disease developed. In 1940 the picture suddenly changed. Be-

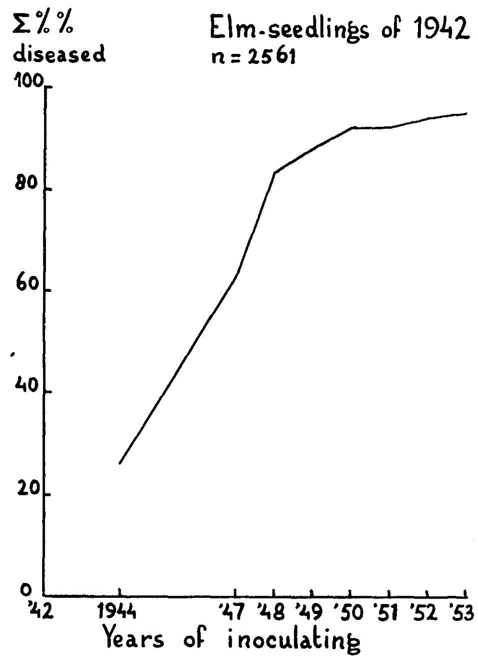

Fig. 5. — Graph, denoting the increasing sum-percentage of seedlings that take the disease in successive inoculation-years.

tween 1940 and 1943, from 735 inoculated trees (partly new young grafts of 2 years of age) 94, i. e. 13% took the disease showing somewhat heavier symptoms. (For practical use, this susceptibility was still to be tolerated). — A similar jump in susceptibility is observed in most clones about which enough data are available. In two cases, it compelled the Committee to withdraw promising clones that were on the edge of being released to trade.

It is noteworthy, that these changes in susceptibility occurred in the same year as, or a few years before the seedling or some of the older grafts started to flower. Here may lie a clue to the understanding of the said changes. since it is known that every tree undergoes morphological and physiological changes in developing from a young seedling into a tree that is able to flower (see e. g. SCHAFFALITZKY DE MUCKADELL 1954). In this interval, also in elm many properties change: nervation, hairiness, serrature, size and form of leaves, length of petioles, size of buds, tendency to form cork, etc., and it is therefore not surprising that also the degree of susceptibility should alter during this juvenile phase.

If this interpretation of facts is correct, there is no need to fear that in course of time susceptibility of a given clone might increase again and again, as it is generally agreed upon that in the adult phase clones are very stable. MICHURIN (1954) too, though believing firmly in a great plasticity of characters in juvenile fruit-trees, found the adult trees to be highly unvarying as to properties.

Meanwhile, this juvenile resistance of the elm is very inconvenient during breeding, since it costs time and a large nursery, if trees have to be grown until the adult phase is reached, before a definite opinion about their resistance can be formed. It would be of great value if the period could be shortened.

4. Minimum requirements to an elm clone in different areas

Several environmental factors influence the degree in which the disease occurs in the field. BURGER (1938) collected a great amount of data on the dying of elms in this country, and found that besides sanitation, the type of soil had some influence on the rate of dying of the trees. In a certain part of his observations however, another factor, the wind, may have played a role too. Generally speaking, inland, the elms have been killed quickly and nearly completely, whereas in the coastal provinces, some fine plantations have survived even up till now. In some instances, people very near to the coast even start planting again the very susceptible *U. hollandica belgica.* In other cases, the halfresistant *U. hollandica vegeta* is used here. — The line drawn by BURGER indicating the border of the area in which larger elm plantings still occurred in 1938, shows a striking conformity with lines denoting equal mean wind velocities, e. g. 4.5 m per sec. during summer *(fig. 6).*

Nothing is known about the causes of the influence of wind on the development of the disease. However, several possibilities exist. First of all, high wind velocities slow down the growth of the tree, which will result in lower susceptibility to the disease. Then, wind (especially seawind) helps to avoid low minima of relative air humidity that occur inland, and which may hasten the development of a wilting disease like the elm disease. The daily fluctuations of relative air humidity are kept very low by the

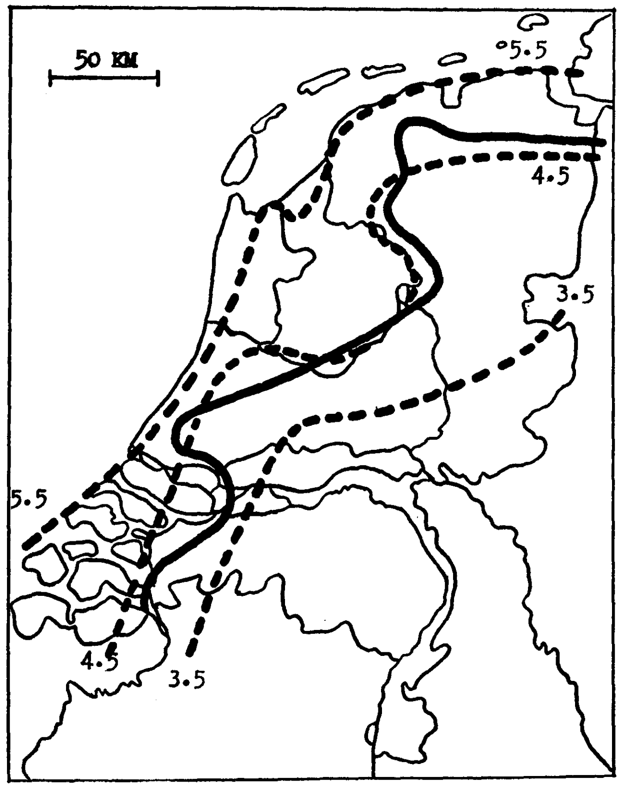

Fig. 6. — Map showing the SE border of areas with larger elm stands surviving in 1938 (drawn line) and lines of equal mean wind velocities in summer, 3.5, 4.5, and 5.5 meter p. sec. respectively (dotted lines). Drawn after BURGER (1938) and BRAAK (1950).

wind too. High wind velocities may in some cases be harmful to the beetles carrying the disease.

Thus, the country may be divided into three areas with increasing danger for damage by the elm disease: 1. the areas flooded in 1953, which are mostly treeless, so that no infection-material has been left; 2. the rest of the coastal provinces; 3. inland. In the same sense, the need for an elm decreases, since inland the species can relatively easily be replaced by other tree species. Thus the risks people are willing to take in planting a new clone with some unknown properties (e. g. rate of growth in middle-aged trees, quality of timber) is much higher in the first mentioned areas than in the last. — It may be concluded that some newly bred clone may be very useful for the flooded areas or for the whole of the coastal provinces, but not at all or not yet for the inland.

5. Results of breeding

As early as 1935, a seedling from Spain, called „Christine Buisman" was released to the growers. In the Netherlands it was not a great success, since growth disappointed and the trees was afflicted by the coral spot disease *(fig. 3).* In Italy and the U. S. A. however, it seems to do well. — In 1947, a seedling from France was released under the name of „Bea Schwarz". It is better than the Buisman-elm, but as to growthrate and shape it cannot compete with *U. hollandica belgica.* Therefore it is not planted in great numbers, except in the town of The Hague.

More important are the following results. During early inoculation-tests it was found that *U. hollandica vegeta* is half-resistant to the elm disease; this tree is being planted on a fairly large scale in some areas along the coast. —

Fig. 7. — *U. carpinifolia* nr. 1, grafted in 1933, now about 15 meter high.

A tree of about the same qualities, *U. carpinifolia* nr. 1, was selected out of a lot of seedlings obtained from a nursery in France. Its resistance to the elm disease is not fully satisfactory, but in other respects it is by far superior to the two released forms *(fig. 7)*. It proved also to be an excellent fathertree in a great number of crosses.

Hybridizing took place between all various species and forms that remained from the original collection after the first selection. Grafts of several of the most promising hybrids are planted out in field trials in Holland now. They are also tried in Canada, England, Germany, Sweden, Switzerland and the U. S. A. Among them, the best trees have got the parentage *U. hollandica vegeta* × *carpinifolia* nr. 1. We hope one or more of them can be released within a few years.

6. Summary and conclusions

1. The elm is indispensable in the open landscape of the coastal provinces of the Netherlands, because of its high tolerance for wind, even seawind. Moreover, it gives very valuable timber.

2. Though breeding became necessary because of the introduction of the elm disease, it does not suffice to select for disease-resistance only. Equal attention must be paid to any property of the tree that is important in practice. Methods for determining quality of timber in younger trees are still lacking.

3. Juvenile resistance to the elm disease exists and is a positive hindrance for selecting quickly. Probably resistance will no longer decrease once the clone has reached the flowering stage.

4. Resistance to a disease is seldom absolute. Therefore, an important job for the selectionist is to judge how much susceptibility can be allowed in practice. He may not release plants with too low a resistance; but if he demands too much of it, he is liable to exclude much important gene-material, especially if susceptibility is more or less loosely correlated with good properties of the tree. Such is the case with the elm. — The minimum requirements for disease-resistance are not the same everywhere; as to the elm disease, they are shown to differ in different parts of the Netherlands.

5. It is hoped that in a few years time, an all-round usable clon will be released to the growers.

Zusammenfassung

Titel der Arbeit: *Ulmenzüchtung in den Niederlanden.* —

1. Als Hof- und Alleebaum war *Ulmus hollandica belgica* die Charakterbaumart der holländischen Küstengebiete. Wegen ihrer großen Resistenz gegen Wind, sogar Salzwind, war sie dort unersetzlich. Auch wegen ihres wertvollen Holzes war sie sehr beliebt.

2. Züchtung wurde notwendig wegen des Auftretens der Ulmenkrankheit. Es werden Klone gesucht, die die *U. hollandica belgica* ersetzen können. Mit dieser Arbeit ist 1928 begonnen worden.

3. Es genügt nicht, nur auf Resistenz gegen die Ulmenkrankheit zu züchten. Jede Eigenschaft des Baumes, die praktisches Interesse hat, muß bei der Züchtung in gleichem Maße beachtet werden. Züchtungziele sind: Resistenz gegen Ulmenkrankheit, Rotpustelkrankheit, Frost und Wind; ferner rasches Wachstum; schöne Form, schöne Blätter; keine Wasserreiserbildung und Wurzeltriebe; Erzeugung wertvollen Holzes.

4. Ulmen weisen eine Jugendresistenz gegen die Ulmenkrankheit auf. Ein rasches Selektieren in den jungen Sämlingen ist daher unmöglich. Die Resistenz wird sich wahrscheinlich nicht mehr ändern, sobald der Klon einmal die Blühbereitschaft erreicht hat.

5. Die Resistenz gegen eine Krankheit ist nur selten absolut. Daraus ergibt sich für den Züchter die Aufgabe, zu beurteilen, welcher Grad von Anfälligkeit in der Praxis noch zulässig ist. Er darf keinen Klon freigeben, der eine zu geringe Resistenz aufweist; wenn er aber zu hohe Anforderungen an die Resistenz stellt, so besteht die Gefahr, daß er in anderer Hinsicht wertvolles Genmaterial ausscheidet. Diese Gefahr ist speziell dann groß, wenn (wie bei der Ulme) die Anfälligkeit mehr oder weniger fest mit guten Eigenschaften des Baumes korreliert ist. — Die Minimalanforderungen, die an Resistenz gegen die Ulmenkrankheit gestellt werden müssen, sind unterschiedlich für die verschiedenen Wuchsgebiete in Holland. U. a. hat die Windgeschwindigkeit einen Einfluß auf das Auftreten der Krankheit *(Bild 6)*.

6. Die zwei Klone, die jetzt für die Praxis freigegeben worden sind, besitzen nur beschränkte Nutzungsmöglichkeiten. Ein allseitig verwendbarer Klon wird hoffentlich in einigen Jahren freigegeben werden können.

Résumé

Titre de l'article: *Amélioration de l'Orme aux Pays-Bas.* —

1— L'Orme est un élément essentiel du paysage des provinces côtières des Pays-Bas, en raison de sa bonne résistance au vent, même au vent de mer. De plus, il donne un bois d'oeuvre de valeur.

2— Les travaux d'amélioration ont été rendus nécessaires par l'introduction de la maladie de l'Orme; mais il ne suffit pas de sélectionner seulement pour la résistance aux maladies. Il faut apporter autant d'attention à tout caractère important dans la pratique. Mais nous ne connaissons pas encore de moyen de déterminer la qualité du bois sur de jeunes arbres.

3— Certains individus résistent à la maladie seulement dans le jeune âge et c'est un facteur défavorable pour une sélection rapide. Mais il est probable que la résistance ne diminue plus une fois que le clone aura atteint le stade de floraison.

4— La résistance à une maladie est rarement absolue. Un des soucis majeurs du sélectionneur doit donc être d'estimer quel degré de sensibilité peut être compatible avec les conditions de la pratique. Il ne peut pas livrer des plants avec une résistance trop faible, mais s'il est trop exigeant, il risque d'exclure des combinaisons de gênes intéressantes, spécialement si la sensibilité à la maladie est liée avec d'autres caractères favorables. Tel est le cas pour l'Orme. Les exigences minimum pour la résistance ne sont pas les mêmes partout; en ce qui concerne la maladie de l'Orme, on montre qu'elles peuvent varier suivant les régions des Pays-Bas.

5— On espère que dans quelques années un clone utilisable partout sera livré aux utilisateurs.

Literature

BRAAK, C.: Het klimaat van Nederland. Den Haag (1950). — BUISMAN, C.: Inoculaties met behulp van iepenspintkevers. Meded. Iepenziekte-comité, nr 22 (1936). — BURGER, F. W.: Iepensterfte in Nederland. Tijds. o. Plantenziekten 44, 177—207 (1938). — CAROSELLI, N. E., and FELDMAN, A. W.: Dutch elm disease in young elm seedlings. Phytopathology 41, 46—51 (1951). — EKLUNDH-EHRENBERG, C.: Almsjukan. Sv. Skogsvårdsf. Tidskr. 52, 35—41 (1954). — FRANSEN, J. J., and BUISMAN, C.: Infectieproeven op verschillende iepensoorten met behulp van iepenspintkevers. Tijds. o. Plantenziekten 41, 221—239 (1935). — HOUTZAGERS, G.: Het geslacht *Populus*. Wageningen (1937). — HUNT, J.: Taxonomy of the genus *Ceratocystis* Lloydia 19, 1—58 (1956). — MITSCHURIN, I. W.: Ausgewählte Schriften. Berlin (1953). — NANNFELD, J. A.: Sv Skogsvårdsf. Tidskr. 32, 408 (1934). — SCHAFFALITZKY DE MUCKADELL: Juvenile stages in woody plants. Physiologia Plantarum 7, 782—796 (1954). — WENT, JOH. C.: Compilation of the investigations on the susceptibility of different elms to *Ceratostomella ulmi* BUISMAN in the Netherlands. Phytopath. Zeits. 9, 181—201 (1938). — WENT, JOH. C.: The Dutch elm disease. Tijds. o. Plantenziekten 60, 109—127 (1954). — WESTEINDE, J. C. VAN 'T: Zeeuwse beplantings problemen. Boomkwekerij 8, 140—144 (1953). — WESTENBERG, J.: On the history of the *Graphium* disease of the elm tree. Tijds. o. Plantenziekten 38. 61—66 (1932). — ZIEGER, E.: Das Ulmensterben. Der Wald 1, 21—26 (1952).

Berichte

Second Lake States Forest Tree Improvement Conference

August 30—31, 1955[1])

The 1955 conference, held under the auspices of the Lake States Forest Tree Improvement Committee, was held at Wisconsin Rapids, Wisconsin. It was attended by 72 forest genetics research workers and forest managers employed by federal and state governments, universities, and industry.

The program consisted of progress reports of various research agencies (pp. 1—46), panel discussions on seed and pollen (48—54), vegetative propagation (pp. 55—74), testing for resistance to pests (pp. 80—88), and committee reports (pp. 100—104). The proceedings includes a list of all present and a list of the common and scientific names of all trees mentioned.

DICKERMAN, M. B.: Recent progress in forest genetics work at the Lake States Forest Experiment Station. *pp. 1—3.*
The station inaugurated a full-time forest genetics program in 1954, with a field center at Rhinelander, Wisconsin. Examination of seed source studies already underway (17-year-old red pine and 2-year-old jack pine), and cooperating in the outplanting in many places of the 30-origin jack pine test, comprised much of the initial efforts of the new project. Much of the future emphasis will be on spruce genetics.

PAULEY, SCOTT S.: Progress report on forest tree improvement studies at the University of Minnesota. *pp. 4—7.*
In cooperation with other agencies a jack pine provenance test involving 30 Minnesota, Wisconsin, and Michigan provenances, and involving the establishing of 17 plantations in those states was started in 1954. Some 120 *Populus* clones are under test at Rochester and Rosemount, Minnesota. A 4-year old open-pollinated progeny test shows the probable presence of F_1 *Ulmus pumila* × *americana* hybrids. A study of variation in *Picea pungens* is underway at Austin, Minnesota. The University offers graduate training in forest genetics.

AHLGREN, CLIFFORD E.: Tree improvement work in progress at the Quetico-Superior Wilderness Research Center. *pp. 7—8.*
The center is located on Basswood Lake, Superior National Forest, Minnesota. So far emphasis has been placed on grafting of *Pinus strobus, P. resinosa,* and on certain interspecific grafts. In both pines best success was obtained by topworking 4- to 20-foot trees with side-slit grafts on the leader in the spring, and leaving 8 to 10 inches of the stock terminal as a support for the scion for about 2 years. Many of the *P. strobus* scions from old trees have flowered in their first to third years.

HITT, R. G.: Tree improvement reserarch at the University of Wisconsin. *pp. 9—10.*
Intraspecific selection, breeding, and grafting programs have been underway for several years in *Pinus strobus, P. resinosa, P. banksiana,* and *Picea* spp.; interspecific breeding and testing in *Populus.* In an afternoon field trip members of the conference saw work underway on grafting, production of control-pollinated stock, tree cimbing, rooting, air layering, flower induction, provenance tests, field testing, and field selection.

SPURR, STEPHEN, H.: Report on forest tree improvement work at the University of Michigan. *pp. 10—11.*
The forest genetics program is concerned primarily with the training of graduate students.

ROBBINS, P, W.: Progress report for Michigan State University. *pp. 11—12.*
The University's program has included revision of the regulations for seed purchase and collection, testing of the sugar content and resistance of the sap to microbial contamination of 120 sugar maples, and the establishment of test plantings of hybrids available from other agencies.

JORANSEN, PHILIP N.: Progress report, the Institute of Paper Chemistry. *pp. 12—14.*
The genetics department of the Institute has a new building and greenhouse, a nursery, and several testing sites. Polyploid aspens from several testing sites. Polyploid aspens from several

[1]) Proceedings, Lake States Forest Tree Improvement Conference, August 30 — 31, 1955. U.S. Department of Agriculture, Forest Service, Lake States Forest Experiment Station. Miscellaneous Report 40: 108 pp. December 1955.