

New Perspectives for the Use of Elms as Street Trees

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Abstract

As a result of the continuing problems with Dutch elm disease in the Netherlands the dominant role of elm as a street tree has diminished strongly in the last decades of the 20th century. New cultivars with increased resistance to DED are used to a limited extent only. This paper reports on the first results of a project that aims to restore the position of the elm as a street tree in the Netherlands by providing information on these new cultivars. In particular the relative levels of resistance and their value as street tree are being tested. From the preliminary results it follows that there is a large variation in resistance and that there are several cultivars available that show no or only limited symptoms after severe inoculation in an experimental field test. In addition design and first results of the evaluation of their value as street tree are described.

INTRODUCTION

In the past centuries elms (*Ulmus* spp.) became a very important part of the landscape in large areas of the Netherlands. Elms have a combination of highly valued characteristics such as no specific requirements concerning soil type, the ability to resist (sea) winds, the very good recovery from mechanical damage, its ability to stand de-icing salts and paved surfaces rather well and its open crown. In fact the elm is the ideal street and landscape tree for large areas in the Netherlands. This made the elm, and especially *U. hollandica* cultivars, the dominant tree in the coastal areas as well as in the large cities in the western part of the country at the beginning of the 20th century.

The spread of Dutch elm disease (DED), caused by *Ophiostoma ulmi* and later *Ophiostoma novo-ulmi*, during the 20th century however resulted in millions of trees being lost. Breeding programs for developing resistant cultivars were started in the Netherlands as well as in other countries. Many new cultivars that are less susceptible to DED have been released from these programs and are available to the market now. However, the continuing problems with DED in the old elm cultivars have made many policy makers and managers of urban green very reluctant to using these new cultivars. As a result around the year 2000 the elm, despite its glorious past, was not even listed in the top 20 of street trees produced by Dutch tree nurseries.

A survey published by Hiemstra et al. (2006) stated that there is still no real substitute for the elm. Many species have been tested, but none has the same set of characteristics that makes the elm so well suited as street tree in the Netherlands. The conclusions of the study were threefold: in the Netherlands we cannot do without the elm. DED-resistant elms are available, but are being used to a very limited extent only. The problem is lack of faith in the resistance of the new elm cultivars and lack of information on the growing characteristics of these cultivars.

As a result, in order to restore confidence in the elm in 2006, a research project was started focusing on these new elm cultivars. Three aspects are being investigated: the relative levels of resistance; the best way to propagate (root-stock, own-rooted); and growth characteristics and value as a street tree. This paper describes the work and some first results on the first and third aspect, the work on the second aspect is still in its preliminary phase.

MATERIALS, METHODS AND FIRST RESULTS

Resistance Testing

The aim of this part of the research was to test all recently released new cultivars with increased resistance to DED that are available in Dutch tree nursery industry. For reasons of comparison the old non-resistant cultivars 'Belgica', 'Commelin' and 'Groeneveld' were included. Also *U. pumila* 'Den Haag' (highly appreciated by some managers of green in the Netherlands) and *U. laevis* (which normally in the field is not infected by DED because of unattractiveness for the beetle, which acts a vector for DED) were included. Finally 10 new selections from the Alterra resistance breeding program and one new variety from the 'Resista' group were included. This resulted in 29 cultivars (Table 1) being tested simultaneously in one large field experiment.

In the spring of 2007 about 1200 2-years-old plants were planted on an experimental field on a clay soil near Wageningen. Most of the cultivars had been propagated by budding onto a rootstock as usual in nursery practice. In this case for all cultivars an *U. glabra* rootstock was used. Only the Resista-type cultivars were rooted cuttings as these cultivars in practice are always grown on their own roots. The plants were arranged in a randomised block design with 9 blocks and four plants of each variety in each block. Despite watering after planting a part of the plants was lost as a result of extremely warm and dry weather after planting. Early in 2008 the dead plants were replaced by spare plants from the same field.

Inoculations were started in 2008; in early June and again half July one plant of each variety in each of the 8 remaining blocks was inoculated. This was done by forcing a knife with a drop of 0.12 ml inoculum on it into the vascular xylem of the lower stem. The inoculum consisted of a conidial suspension of *Ophiostoma novo-ulmi* (10^6 con/ml). These inoculations will be repeated each time with a new set of trees in 2009. Symptom development is recorded after 4 and 8 weeks and in the next year.

Generally in 2008 the inoculum was absorbed by the trees very easily and within two weeks the first symptoms of wilt and leaf necrosis became visible. With time they increased strongly and severe defoliation and dieback became apparent in many trees. Symptoms have been assessed 4 and 8 weeks after inoculation by means of a combined disease index for leaf symptoms (wilt, necrosis, defoliation) and dieback of twigs and stems. The disease index ranges from 0-4 with DI 0 meaning healthy and DI 4 meaning over 50% dieback. Preliminary results are illustrated in Figure 1.

Evaluation of Value as a Street Tree

In this part of the research all the cultivars are included that are readily available in the tree nursery industry in the Netherlands (Table 1). In co-operation with the City of Amsterdam two large test plantings have been realised. The first one was realised in the harbour area west of Amsterdam. In the spring of 2007 here 150 trees of 16 cultivars were planted along a road in an open and windy area. The trees were planted in an individually randomised design.

The second test planting is being realised in a newly developed living quarter (IJburg) at the east side of the city Amsterdam. Here several streets are planted with about 260 trees of 11 cultivars; the vigorously growing ones have been left out because of the surrounding buildings. Lutèce, a variety from the same breeding programme as Columella and introduced in France, was added as an extra variety to be tested. Planting has been started in 2007 and will continue till 2010. Again the planting design was individually randomised.

So far the trees at both sites are doing well. Their growth is recorded annually and the development of the trees is monitored by recording stem and crown parameters, as well as the occurrence of diseases, disorders or any specific anomalies. Representative trees are photographed regularly. These observations will be continued for at least 5 years. In order to draw more general conclusions about the cultivars tested small satellite plantings in other cities will be developed in the coming years.

DISCUSSION AND CONCLUSIONS

The elm is a very useful street tree in large parts of the Netherlands. Its use however has diminished strongly as a result of the lasting problems with Dutch elm disease. Also the new supposedly less susceptible cultivars are presently not used to the extent that is possible. This project aims to contribute to the return of elms as a major street tree in the Netherlands by assessing the relative levels of resistance of the recently introduced new – so-called resistant – cultivars as well as their value as street tree.

The resistance testing experiment is only halfway. Therefore at present only preliminary results are available, though promising. The results of the inoculation experiment clearly demonstrate a large variation in response to infection with DED with some cultivars showing almost no or very limited symptoms and other cultivars showing very severe disease symptoms. Also when the average disease index, 8 weeks after the first inoculation of the cultivars is put in an array from low to high (Fig. 1) the order of the cultivars corresponds very well with the information from practice. This is not only true for ‘Columella’ (cultivar nr. 1) being the most resistant and ‘Belgica’ (cultivar nr. 29) being the most susceptible variety, also the position of other well known cultivars is as expected. So the test procedure does work well. The figure also shows that there is a considerable number of cultivars with a rather high level of resistance to DED! It is too early to be conclusive on the exact position of individual cultivars within the range. The figure represents only data from one date of observation. In the final results, however, after repeating the inoculations in 2009, it will be possible to come to sound conclusions and recommendations on individual cultivars.

For conclusions on the value as street tree of the cultivars tested it is still too early. However two large plantings in very different growing conditions have been realised with additional smaller plantings in other areas. In time these test plantings certainly will contribute to the knowledge on growth characteristics and habit of the tested cultivars.

Literature Cited

Hiemstra, J.A., Buiteveld, J., Kopinga, J., Kranenborg, K.G., Ravesloot, M.B.M., Van der Sluis, B.J. and de Vries, S.M.G. 2006. Belang en toekomst van de iep in Nederland. Rapport PPO 421, Praktijkonderzoek Plant en Omgeving, Lisse. 51 p.

Tables

Table 1. Elm cultivars included in the experiments.

Elm cultivar	Resistance testing	Evaluation of street tree value
Dutch selections:		
Belgica	X	--
Commelin	X	--
Groeneveld	X	X
Lobel	X	X
Dodoens	X	X
Plantijn	X	X
Clusius	X	X
Columella	X	X
Lutèce	--	X
10 new selections from Alterra	X	--
Resista elms (USA):		
Cathedral	X	X
New Horizon	X	X
Regal	X	X
Rebona	X	X
Sapporo Autumn Gold	X	X
No 2245-9	X	--
Other selections from the USA:		
Homestead	X	X
Pioneer	X	X
Urban	X	X
Additional species:		
<i>U. laevis</i>	X	X
<i>U. pumila</i> Den Haag	X	X
Total number	29	17

Figures

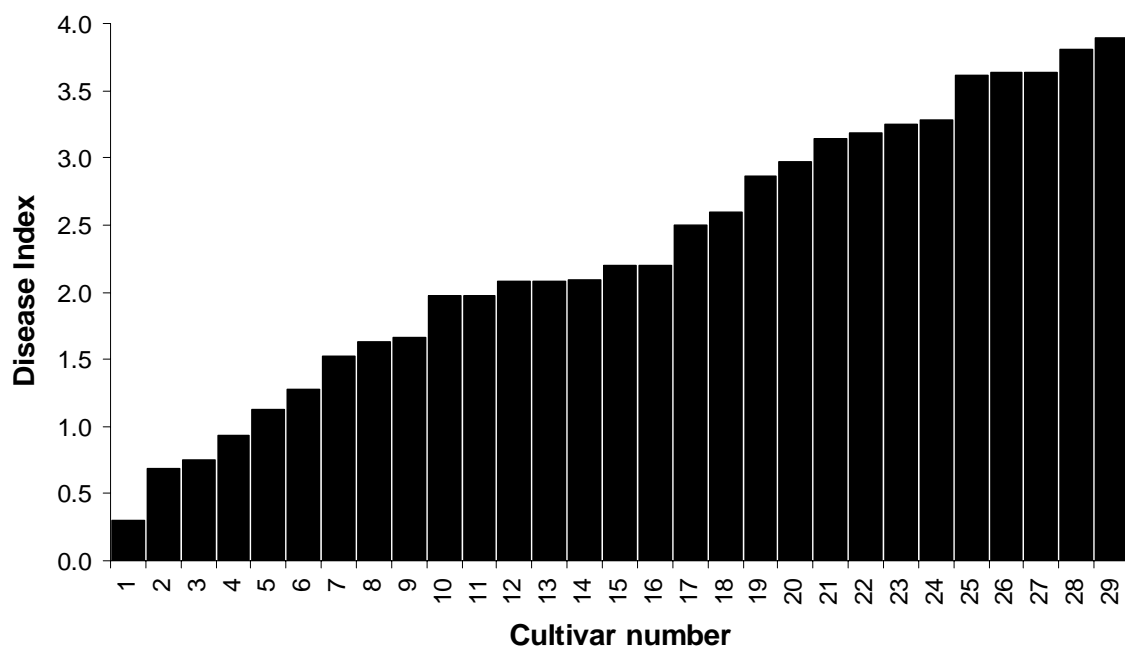


Fig. 1. Average disease index 8 weeks after inoculation (June 2008) for all 29 cultivars included in the experiment (see text for explanation).

