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Preface

Denmark has a long-standing tradition for working with applied forest genetics based on seed from selected, healthy, productive and straight elite trees. Over the previous 60 years this work has implied a close cooperation between the Arboretum in Hørsholm and The Tree Improvement Station in Humlebæk. The Arboretum (since 2004 a part of Forest & Landscape, University of Copenhagen) has over the years selected, developed and tested superior seed-trees, whilst The Tree Improvement Station (today a part of The National Forest & Nature Agency, Øresund) has worked with effective propagation and distribution of improved material on a national scale. Strategies as well as tangible plans are regularly discussed and coordinated. The cooperation has been a strong link between research on the one side and forestry on the other, and since 1947 the Forest and Nature Agency has established, managed and harvested seed from an extensive network of seed sources, which, as far as seed orchards are concerned, have all been established in interaction with Forest & Landscape for breeding purposes.

One of the first seed orchards in the systematic breeding work is FP202. Selection and grafting of particularly interesting ash trees was started in 1934 in the Forest Botanical Garden under C. Syrach-Larsens direction (Larsen, 1945). In 1945-46 there was a large scale propagation of 14 selected clones. Helmuth von Barner was responsible for planting 977 of these graftings at an area close to the newly started Tree Improvement Station in 1947, thereby establishing the (to our knowledge) Worlds first Ash seed orchard. FP202 has since developed into one of the most important seed sources of ash in Danish forestry. In later years it has been the preferred seed source in Danish Forestry due to its origin from straight trees, but also because FP202 is expected to have the highest level of genetic diversity among the three ash seed orchards on the Danish market.

Due to the recent problems with ash dieback, special interest for the clones in FP202 has arisen. Dieback is supposedly caused by a fungus '*Chalara fraxinea*'. Though there are still many unanswered questions concerning this serious illness (Thomsen *et al.*, 2008), it is very interesting that some clones show considerable resistance. FP202 contains both resistant and susceptible clones, and since 2007 it has become particularly interesting to study progenies from FP202 in order to increase the understanding of the genetic aspects of the disease and the option for breeding to increase resistance (Olrik *et al.*, 2007). This work has included selective harvest from healthy clones in 2008.

Many years have passed since the first elite ash tree was selected and grafted in the 1930'ies, and there are many steps where mistakes could have occurred since. It is not possible to discern clones from each other by their appearance, and correctness of the clone identity in FP202 is therefore completely dependent on the high degree of care taken by all those involved from 1930'ies up to today. Fortunately, it is now possible to control the clone identity by DNA markers, and with this knowledge we decided to

control the clone identity of FP202, 60 years later. This report deals with the technique, results and conclusions of the analysis. In the appendix we have selected documentation concerning FP202's establishment and treatment material which has only partly been published earlier.

Helmuth von Barner and C. Syrach-Larsen (who founded and managed the seed orchard for more than 40 years) would have been delighted by the results. There are only very few technical errors in this the (maybe) oldest ash seed orchard in the world.

Hørsholm og Humlebæk, December, 2008

Erik Dahl Kjær, Lars Graudal og Bjerne Ditlevsen

Content

Abstract

The *Fraxinus excelsior* clonal seed orchard FP202 was established at Birkemarken, Humlebæk, Denmark in 1947, and is to our knowledge the first *Fraxinus* clonal seed orchard established worldwide. 61 years after establishment we tested clonal identity of remaining ramets by application of 4 polymorphic SSR markers. FP202 consists of alternating rows of the predominant male clone V282, and 8 predominant female clones: V702, V703, V704, V710, V791, V792, V793, V797. However, unpublished observations suggest that V797 may have substantial contribution to the male gamete pool, and that the gender function of V793 also is uncertain.

Among ramets labelled as V702, V703, V704, V710, V791, V792, V793, V797 a single genotypic mismatch was observed (Tree 24-02, probably a rootstock). Further, one V791 ramet was mistakenly labelled V282 (Tree 09-03). An important additional finding was that V702 and V703 ramets had identical genotypes and therefore most likely originates from the same ortet. We cannot infer from the data if it is V702 or V703 that is the correct name. 60 of the ramets labelled V282 (male) had identical genotypes, but 5 ramets had an alternative genotype suggesting that they form an extra male clone represented by 5 ramets scattered in the V282 rows. The origin of this clone is unknown, but is probably introduced by mistake during the graftings in 1945-46. A single ramet labelled V282 is probably a root stock.

To conclude: 115 trees (93%) had a DNA profile that fits the documentation even though it shall be noted that V702 and V703 ramets probably form a single clone. 8 trees deviated from the expected: 2 trees are likely root stocks, 1 tree had an incorrect label, and 5 trees form an additional clone of so-far unknown origin.

Danish summary

Træer i aske klonfrøplantagen FP202 (Birkemarken) blev undersøgt med DNA markører for at kontrollere deres klonidentitet. FP202 består (ifølge anlægsrapport og øvrig dokumentation) af rækker med (overvejende) hanlige træer (alle klon V282) som alternerer med rækker af overvejende hunlige træer (8 kloner rækkevis: V702, V703, V704, V710, V791, V792, V793, V797). Det skal dog bemærkes at Helmuth Barner i 1976 indikerer at V797 sandsynligvis er hanlig (♂?) og at V793 er tvilsom i forhold til hanlig/hunlighed (cf. Appendix 2, nedenfor), selvom begge kloner producerede en del frø i plantagens unge år (cf. Appendix 1, nedenfor) .

Resultaterne af DNA analysen er sammenstillet i Figur 1 og Tabel 2. Baseret på DNA analyserne konkluderer vi, at der i hunrækkerne kun forekommer én afvigelse (vi antager der er tale om en grundstamme). Dog bemærkes at to af de hunlige kloner (V702 og V703) med stor sandsynlighed er identiske idet de har samme DNA profil. Blandt de 67 træer i hanrækker identificerede vi ét træ som ikke passede med de øvrige, men i stedet kunne identificeres som V791. 60 træer i hanrækkerne havde identisk genotype, som vi derfor antager er V282. 5 træer spredt i hanrækkerne havde identiske genotyper, som dog afvej fra øvrige, og vi konkluderer på den baggrund at frøplantagen indeholder én ekstra klon repræsenteret med 5 rameter. Denne klon er sandsynligvis introduceret ved en fejl under podearbejdet i 1945-46, men oprindelsen af klonen er usikker. Endelig observerede vi ét træ i hanrækkerne, hvis genotype afveg fra alle andre træer, og vi derfor antager er en grundstamme. I alt 115 ud af de 123 undersøgte træer (93%) havde således en DNA profil som passede med det forventede ifølge dokumentationen. Et enkelt træ blev af tekniske grunde ikke undersøgt og indgår derfor ikke i analyserne.

Konklusion: Frøplantagen indeholder 124 træer, hvoraf 8 træer har en DNA profil som afviger fra forventningen ud fra dokumentationen: 2 træer antages at være grundstammer, 1 træ antages plantet forkert i forhold til kortet (evt. forbyttet podekvist), 5 træer udgør én ekstra klon fordelt i hanrækkerne. DNA-analysen afslørede desuden at V702 og V703 må antages at være samme klon uden det er muligt at afgøre om det er V702 eller V703 som er den korrekte betegnelse.

1. Introduction

The *Fraxinus excelsior* clonal seed orchard FP202 located at Birkemarken close to the Danish Tree Improvement Station in Humlebæk, is the second oldest existing clonal seed orchard in Denmark. Further, it is to our knowledge the first clonal *Fraxinus* seed orchard established world wise.

The seed orchard has been one of the main providers of *Fraxinus* seed to Danish Forestry since the 1960'ies and is still one of the most used seed sources in Denmark. This would be sufficient reason for investing time and effort in validating the clonal identity of the trees in this old seed orchard. However, a new severe disease which was first observed in 2003, has infected the Danish ash trees dramatically, threatening the use of this important species (Thomsen *et al.*, 2008). In 2007 significant variation was observed between clones in their degree of susceptibility (Olrik *et al.*, 2007) and these important differences have been maintained in 2008. The findings were based on a clonal trial with 40 clones tested at two locations (CSOs). Fortunately, the old *Fraxinus* FP 202 seed orchard includes some of the best performing clones, but also some of the inferior ones. For this reason, the verification of clonal identity in the seed orchard has become increasingly important.

In 2008 it was decided to collect seed exclusively from the healthy clones in the seed orchard. Seeds on these trees are presumably sired by the healthy clone (V282), and the expectation is therefore that such seed would have increased resistance against the disease. However, in order to be able to study such parent-offspring regression as well as in order to ensure seed collection from the correct trees, it was decided in 2008 to perform a full test of clonal identity of all trees in the seed orchard.

The present survey thus has three objectives: (i) to check the clonal seed orchard for »cryptic dysfunctions« due to grafting mistakes or seed/pollen production from root stock (cf. Hansen & Kjær, 2006), (ii) ensure seed collection from correct trees during exclusive seed collection, (iii) to facilitate precise comparison of parent-offspring regression in health and thereby allow studies on heritability and genetic background for the apparent resistance (to be studied in 2009).

The present report documents the applied methods and results of this survey with the three above objectives.

2. The Seed orchard

Establishment and management of the seed orchards are described in some detail in old reports and other written material mainly authored by Helmuth Barner, the director of the Tree Improvement station from its establishment in 1947 until 1988. Two key reports are reproduced in appendix 1 and 2, from where the below description has been extracted:

The seed orchard was established with graftings in 1947 on agricultural land. A total of 14 clones were included, 1 predominantly male clone and 13 predominantly female clones (Appendix 1). Brief description of plus trees and grafting work are included in Appendix 3, and pictures of the majority of the plus trees are included in Appendix 1. The establishment phase included mechanical weeding. Pruning of branches was applied in 1953 and 1954 to increase seed set, but with very limited effect. Application of fertiliser and removal of grass did increase the health and growth of the seed orchard trees, but did not lead to substantial seed yield (Appendix 1).

5 of the female clones were removed in 1961, leaving only 8 predominantly females (V702, V703, V704, V710, V791, V792, V793, V797), and one predominantly male (V282). However, in 1976, Helmut Barner questions if V793 and V797 are truely predominantly females (cf. Appendix 2), and these 2 clones may therefore also be important pollen donors in the Seed orchard. Further information on the selection and propagation of the individual clones are included in Appendix 3.

3. Methods

Sampling

Leaf material was collected on September 10th 2008. Two leaves were collected from each tree throughout the seed orchard. Each sample was labelled according to their position on the map (Figure 1). In total, 67 samples were collected from the male rows (presumed V282) and 56 samples from the female rows (presumed V702, V703, V704, V710, V791, V792, V793, V797). The material was stored at -20 °C until DNA extraction.

Genotyping

15-20 mg leaf tissue per individual was treated with liquid nitrogen and ground on a bead mill without any prior preparation. DNA extraction was carried out with the DNeasy 96 Plant Kit from QIAGEN following the manufactures protocol for frozen material.

The DNA-extractions were kept undiluted for the polymerase chain reaction. Eleven primer pairs developed for *Fraxinus excelsior* were initially tested. Ten of these (FEMSATL1, 2, 4, 5, 8, 10, 11, 12, 16, 19) were all developed by Lefort *et al.* (1999). FEMSATL12 has later been modified by Gerard *et al.* (2006) and it was the modified version that we tested. The last primer pair (M2-30) was developed by Brachet *et al.* (1999). Four polymorphic, interpretable microsatellite loci were identified and used for further genotyping. The chosen primer pairs were FEMSATL11, FEMSATL12, FEMSATL16, FEMSATL19.

PCR reactions were carried out using the Qiagen Multiplex PCR kit according to the manufacturer's instructions except that the reaction volumes were scaled down to 15µl. PCR-amplifications were completed on Perkin Elmer Thermo cyclers (models 9700 and 2700) under the following conditions: an initial denaturation step of 15 min at 95 °C, 30 cycles of denaturation at 94 °C for 30 s, annealing at 57 °C for 90 s and extension at 72 °C for 60 s, and a final extension step at 60 °C for 30 min. Each amplified product was diluted with 30µl H_2O and visualized with an ABI3130xl sequencer from Applied Biosystems.

4. Results

In Table 1 we see that the amplification of the 4 microsatellite loci in total resulted in 35 alleles. This level of polymorphism was highly sufficient to distinguish between the genotyped clones.

Table 1. Number of alleles per microsatellite locus. The alleles are given in base pairs

	Femsatl11	Femsatl12	Femsatl16	Femsatl19
1	183	172	186	174
2	185	174	188	176
3	191	176	196	180
4	193	178	200	182
5	197	190		186
6	201	196		188
7	203	198		190
8	205	200		192
9	213	204		194
10		206		198
11		211		202

Of the 67 examined male trees (labelled V282) it turned out that 60 ramets had identical genotype (recognized as V282, Table 2). The remaining seven were of a different genotype. One (position 0905) turned out to have same genotype as V791 and may thus be a wrong grafting. One was not recognized elsewhere (position 0307) and may be a root stock. The last 5 (positions 0107, 0901, 0909, 1505, 1903) all had the same genotype (see Table 2) that did not match with any of the others.

Among the female rows, only 1 tree (labelled V702, position 2402) did not resemble any other genotype and may thus be a root stock. However, very interestingly trees labelled V702 and V703 turned out to have identical genotype, and it is therefore very likely that they originate from the same ortet (= the same clone).

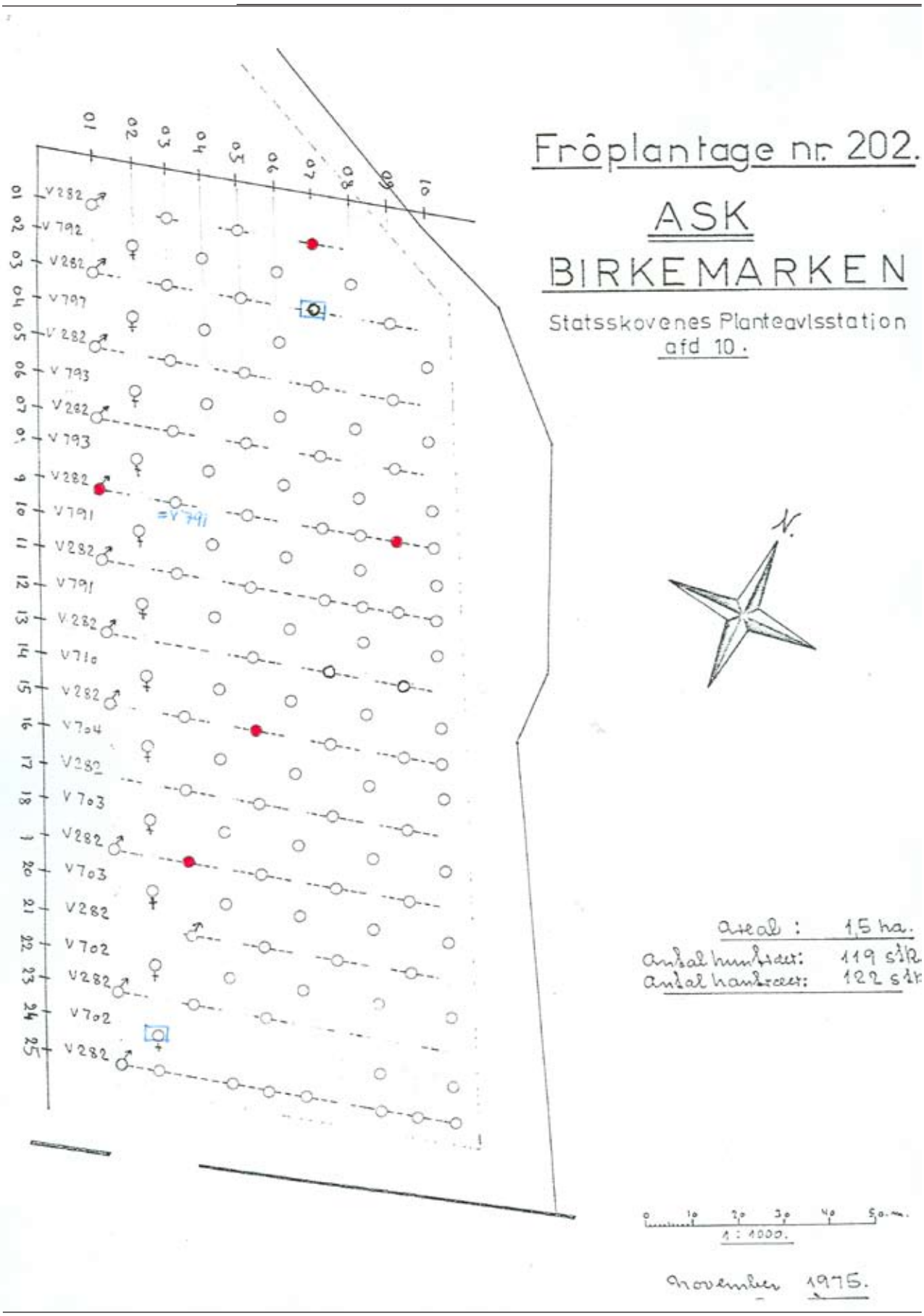


Figure 1. Positions of trees with deviating genotypes compared to documentation. Marked in red: »Extra male« = five trees with identical genotypes that are not identical to the V282 genotype. The two squares show the trees with no match. V702 and V703 turned out to have identical genotypes.

Table 2. Summary of the genotypes of the clones of *Fraxinus excelsior* from Birkemarken (seed orchard FP202). Alleles are given in base pair lengths at each of the 4 loci.

Clone ID	Femsatl11		Femsatl12		Femsatl16		Femsatl19	
V282	183	201	174	174	186	200	180	188
V702	191	205	176	196	188	188	180	192
V703	191	205	176	196	188	188	180	192
V704	193	213	190	206	186	200	174	188
V710	183	203	172	190	186	186	190	190
V791	185	191	174	178	200	200	176	186
V792	183	191	174	174	186	186	188	194
V793	183	191	200	204	186	196	182	186
V797	197	205	190	200	188	188	186	192
Extra male (0107, 0901, 0909, 1505, 1903)	183	191	174	190	186	188	198	202
Male with no match (0307)	193	205	174	211	186	186	188	194
Female with no match (2402)	197	201	190	198	188	188	188	192

Please note that V702 and V703 have identical genotypes and it is therefore highly likely that it is indeed the same clone.

5. Conclusion

In conclusion, the seed orchard corresponded to 7 clones in female rows and 2 clones in the male rows rather than 8 clones in female rows and 1 clone in male rows. Besides this, there were only few unexplained deviations (1 assumed wrong/misplaced grafting, and 2 likely root stocks). According to old records, 2 of the clones in the female rows may produce significant amount of pollen and the pollen production id therefore likely to be distributed on more than one clone.

The identity of the »extra male« remains unknown. We have genotyped 40 clones deployed in different Danish seed orchards, but none of these match (Nielsen, unpublished results). A screening of old clonal archives with *Fraxinus* may reveal the true identity of this »extra male«, but this will probably not be an easy matter. Studies of segregation in terms of health of progenies from FP202 will be performed in 2008-2009, and here we will look for progenies sired by this »extra male«. Based on this parental analysis we expect to be able to determine the health status (in term of breeding value) of the »extra male«. This will only be possible if the clone has been sufficiently male fertile to sire a fair number of progenies in our progeny sample. Based on the results it will be possible to recommend if the clone should be removed from the seed orchard or maintained.

6. References

Brachet, S., Jubier, M.F., Richard, M., Jung-Muller, B., Frascaria-Lacoste, N. 1999.
Rapid identification of microsatellite loci using 5' anchored PCR in the common ash (*Fraxinus excelsior*). *Molecular Ecology* **8**, 157–168.

Gerard, P.R., Fernandez-Manjarres, J.F., Frascaria-Lacoste, N. 2006.
Temporal cline in a hybrid clone population between *Fraxinus excelsior* L. and *Fraxinus angustifolia* Vahl. *Molecular Ecology* **15**, 3655–3667.

Hansen, O.K., Kjær, E.D. 2006.
Paternity analysis with microsatellites in a Danish *Abies nordmanniana* clonal seed orchard reveals dysfunctions. Canadian Journal of Forest Research **36**, 1054–1058.

Larsen, C.S. 1945.
Blomstring og Forædling hos ask. Dansk Skovforenings Tidsskrift 30: 49-89.

Lefort, F., Brachet, S., Frascaria-Lacoste, N., Edwards, K.J., Douglas, G.C. 1999.
Identification and characterisation of microsatellite loci in ash (*Fraxinus excelsior* L) and their conservation in the olive family (Oleaceae). *Molecular Ecology* **8**, 1088–1091

Olrik, D.C., Kjær, E.D., Ditlevsen, B. 2007.
Klonforskelle i angreb af asketoptørre. SKOVEN **39**, 522–525

Thomsen, I.M, Kjær, E.D., Skovsgaard, J.P., Nielsen, L.R 2008.
Status for asketoptørre i Danmark. Grønt Miljø 10/09: 4–6.

FP 202, December 2008. Pruning has been applied to increase fruiting and ease seed collection (cf. Annex 1 below). Many trees therefore have low twigs. However, today the clonal identity is correct on most trees and the DNA analysis only identifies two trees to be likely root stock. This result proves careful pruning and removal of root stock sprouts in the seed orchard.

Appendix 1: Description of the establishment of FP202

Source: Selected part of the unpublished document 'Frøhaver Ask', which is part of the old files at the Arboretum. The file is undated and the authorship is not stated. We believe it was written by Helmuth Barner, the former director of The Danish National Tree Improvement Station, who was responsible for the establishment and management of the seed orchard.

We are not sure about the date. The document refers to the flowering in 1960, and is likely to be prior to 1961, because it does not refer to the thinning of the clonal seed orchard that was performed in that year according to documents from 1976 (appendix 2 below). The document include numbers of seed harvested up till 1966/67, but these figures may have been added later as no references are given to flowering after 1960. We therefore assume that the document dates around autumn 1960.

Planteavlsstationen
Birkemarken
Areal: 1,5 ha.

Ask
Frøhave 2o2.

Formål: Produktion af askefrø.

Isolering: Isolering fra omgivende ask ret god, ca. 5oo m gennem skov til nærmeste askebevoksning, der er gammel og næppe blomstrer mere.

Avlsmaterialet: Som huntræer indgår i plantagen følgende, der er udvalgt af dr. Syrach Larsen:

		udplt.	
V. 7o2	Stenderup: Nørreskov afd. 12 træ nr. 1	8o stk.	podet 1946
V. 7o3	- : - - 1o - - 2	8o -	okul. 1945
V. 7o4	Boller: Nedørskov afd. 3o	4o -	podet 1946
V. 71o	Tåsinge: Horse skov afd. 5	4o -	- 1945 ?
V. 791	Sorø I : Broby Vesterskov afd. 63 a	8o -	okul. 1945
V. 792	Sorø II: St. Bøgeskov afd. 67 A	2o -	- 1945
V. 793	Sorø II: Ll. Bøgeskov afd. 82 a Prfl. F.K.[a]	8o -	podet 1946
V. 797	Hørsholm: Stasevang afd. 274 træ nr. 1	4o -	okul. 1945+46
V. 869	Svenstrup: Dalby Skov afd. V 23 a	4 -	- 1945
V. 894	Bregentved: Grevindeskoven afd. 9o	4 -	- 1945
V. 895	Bregentved: - " - - 112	2 -	- 1945
V. 896	Bregentved: - " - "Jubilæumsasken"	5 -	- 1945
V. 898	Svenstrup, Kimmerslev, Hessel afd. 11	2 -	- 1945

Som han er anvendt V. 282 Stenderup Nørreskov.
Prfl. F.O. Træ nr. 44. 5oo stk. (til og med 5 rk. 1o. plt. p. 46 derfra og til og med 34 rk. 16. plt.) fra syd) (ok.45, resten ok. 44

Plantagen er anlagt i foråret 1947 i den østligste del af Birkemarken, V. 282 indgår med 2 rækker i hver anden dobbelt række, huntræerne indgår derimellem som vist på skitsen.

Alt materialet er leveret af Arboretet i Hørsholm.

Planteafstand 4 x 4 m.

Plantagens udvikling: Plantagen blef anlagt på gl. agerjord, der lige efter overtagelsen blev behandlet med harvning, hvorefter askene blev udplantet. De første 3 år blev der til stadighed renholdt med harvning, hvorefter man indskrænkede sig til at holde græsset nede med slåning.

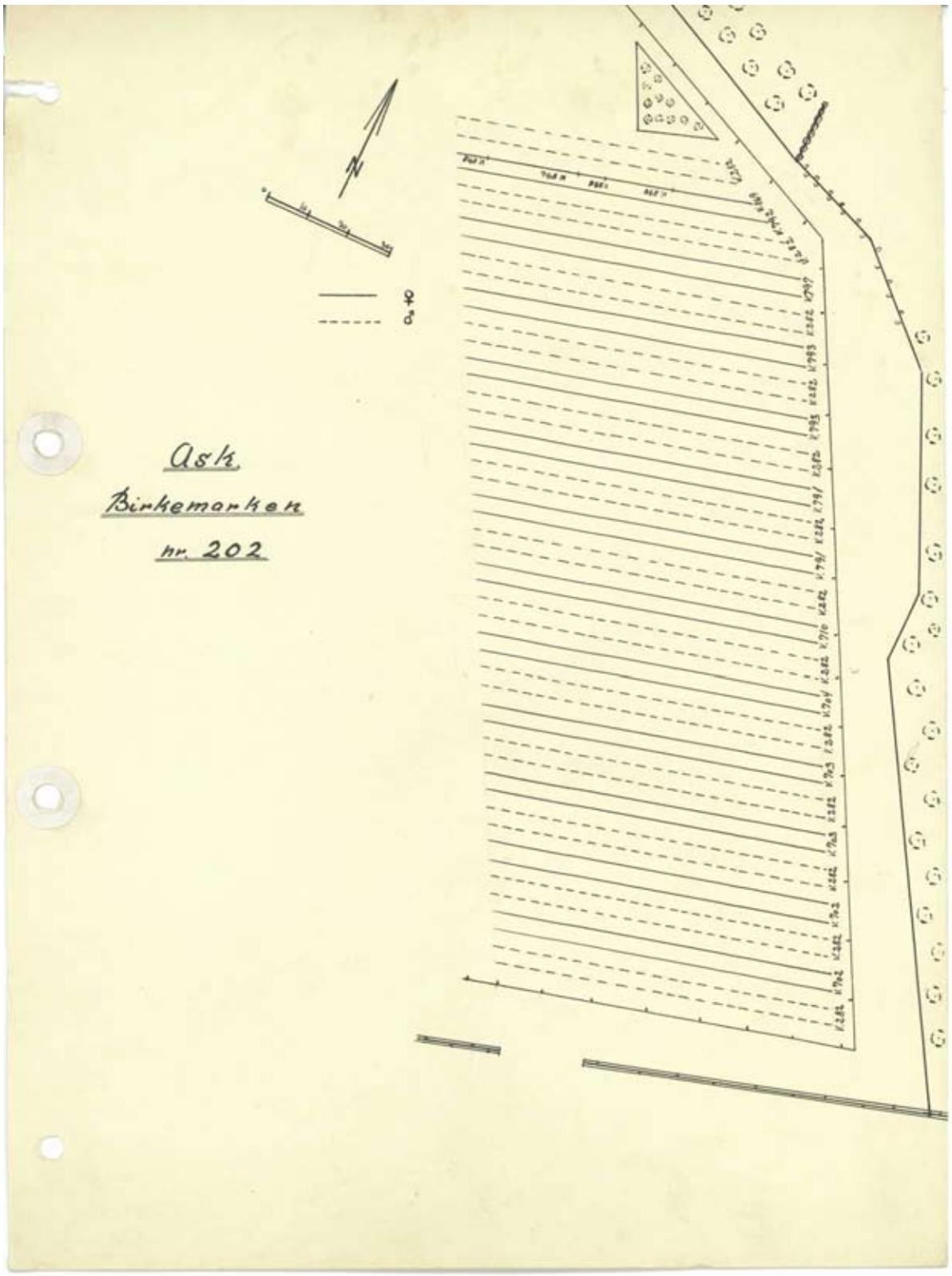
For at prøve dels at påvirke frøsætningen, dels at lette plukningen, klippede man første gang i vinteren 1953/54 i rækkerne med huntræer, grenene ind på hveranden ask i hver række (i forbundt). Dette blev gentaget i 1954/55 med de samme træer. - Intet udslag!

fot. Juli 1956 , Pl.

HØST AF FRØ I FRØHAVE 202.

kg + frø

♂ V.282	Freparti	Årgang	V. 702	V. 703	V. 704	V. 710	V. 791	V. 793	V. 797	V. 792	V. 869	V. 894	V. 895	V. 896	V. 898	Ialt
		1953/54	10,19	0,10	3,85	11,83	25,80	12,90	13,30	0,07	0	3,27	0	0,01	0	81,32
		58/59	23,00	0,48	8,50	7,40	10,30	1,12	5,00	3,00	0	0,70	0	0	0	111,50
34.4		60/61	32.0	0.3	0.1	19.0	26.6	19.9	40 52.7	11.7	0	2.0 11.3	0	0	0.2	208.2
		62/63	9.3	–	3.5	14.9	33.5	55.9	44.2	–	–	1.5	–	–	–	162.8
		65/66				2.7		15.0	0.8	15.4						29.1
		67/68														64


Ask
Birkemarken
nr. 202

Efter at man i nogle år havde holdt arealet med græs, viste det sig, at askene hæmmedes i udviklingen. Bladene blev gullige, og væksten var særlig på midterarealet ringe.

I oktober 1957 fræsede man derfor mellem alle askerækkerne (4 træk mellem 2 rækker ask). Følgende rækkemellemrum blev dog ikke fræsede:

25 - 26 = V. 282
33 - 34 = V. 282

idet rækkerne regnes fra nord.

Umiddelbart herefter blev på tværs af rækkerne givet

7 rækker ask = 225 kg svovlsur ammoniak ialt
6 - - = intet
7 - - = 225 kg kalksalpeter ialt

I foråret 1958 blev følgende tilført:

7 rækker ask = 25o kg svovlsur ammoniak ialt
6 - - = intet
7 - - = 25o kg kalksalpeter ialt

Allerede tidligt på sommeren 1958 sås klart udslag for gødskningen, idet 2x7 gødede rækker fik mørkegrønne, sunde blade. Der konstateredes ikke forskel på de 2 gødningsarters virkning.

Foråret 1959 gødedes hele arealet med 375 kg svovlsur am. og senere med 375 kg. Arealet blev i 1959 holdt med fræsning og er i 196o blevet harvet. Gødskning + fræsning gav klart positivt udslag m.h.t. vækst.

I 1958/59 blev forsøgt en kraftig beskæring af hveranden ♀ træ. Virkningen var, bedømt sommeren 196o, ikke særlig gunstig. Der har som frygtet udviklet sig kraftige vanris på de beskårne træer og blomstringen forår 1959 var ikke bedre på de beskårne træer end på de andre træer.

196o synes at være godt blomstringsår for ask. Blomstringen i frøhaven er dog beskeden og i lighed med de 2 tidligere blomstringsår, er der flest blomster i de laveste dele mod S. og N. Der er dog en nogenlunde god blomstring på ♂ rækkerne også på midterstykket, hvilket tyder på, at det ikke alene er de ydre forhold, der hindrer ♀ klonerne i blomstring på midterstykket.

Ask.
Sorø I,Broby Vesterskov,afd.63 a.
V.791.
fot.den 29/1 -1954.

Ask.
Tåsinge,Horse skov, afd. 5 .
trø mrk.3 gule plett. V.71o.
fot.

Ask.
Sorø II,Gyrstinge,st.Begeskov,afd.67 a.
V.792.
fot.den 29/1 -1945.

Ask.
Bregentved,Sorte led afd.112.
V.895.
fot.den 29/1 - 1954.

Ask.
Svenstrup,Kimmerslev Hessel afd.11.
V.898.
fot. d.22/1 - 1954.

Ask.
Bregentved , Jubilæumsasken.
V.896.
fot.d.22/1 - 1954.

Ask.
Stenderup Nørreskov,afd.12.
trø nr.1.,V.7o2.

Ask.
Bollęr Nederskov,afd.3o.
trø.(gul ring),V.7o4.
fot.den 3o/1-44.

Ask.
Stenderup Nederskov,afd 3o.
trø nr.2 . V.7o3.

Appendix 2: Description of FP202, 1976

Source: Scanned copy of Statsskovenes Planteavlsstation, 1976: Proveniensmeddelse nr 7: Askefrøplantagen FP202 Birkemarken. Skov & Naturstyrelsen, Øresund, Krogerupvej 21, DK 3050 Humlebæk

PROVENIENSMEDDELELSE NR. 7

STAMBOGSBLAD

for

FRØPLANTAGE FP 202

1. Identifikation

1. Træart: Ask, Fraxinus excelsior 2. Løbenummer: 202

3. Ejerforhold: Planteavlsstationen, Skovstyrelsen.

4. Ansvarlig tilsynsførende: Planteavlsstationen

5. Beliggenhed: Planteavlsstationen, Birkemarken afd. 10 b (1972), nær Nederste Torpenvej, Humlebæk.

6. Areal: 1.5 ha 7. Kort: A 2630

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2. Formål: Produktion af frø fra udvalgte, danske Plustræer.

1. Frøets anvendelsesområde: Ingen særlige begrænsninger inden for danske askelokaliteter.

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3. Opbygning

1. Komponenter	Antal ved anlæg	fjernet år	fjernet antal	Formerings-år	Udplantnings-år	Frøhøst indtil	Frøhøst ialt kg
Kloner	14	1961	5	1945 + 46	1947	1/1-76	1241
Familier	0						

2. Udplantningsplan: Dobbeltrækker af hunlige kloner, vekslende med dobbelt rækker af een hanlig klon. Oprindeligt indgik 13 hunlige kloner, der bestøves af een hanask. I 1961 fjernedes 5 hunlige kloner, der kun fandtes i ringe antal.

3. Plantningsafstand: 4 x 4 m.

4. Isolering: Enkelte små askegrupper 200-300 m N.V. for plantagen, enkelte ask ca 450 m gennem skov N. og NV for plantagen, samt 2 små askebevoksninger ca 550-600 m gennem skov NV for plantagen.

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4. Grundmateriale

1. Udgangsbevoksninger. Plustræer valgt i særdeles gode og velformede askebevoksninger.

2. Udvalgsegenskaber. Efter køn for at få hunlige og hanlige kloner samt efter rethed og stammekvalitet.

3. Udvalgsstyrke: Vanskelig at vurdere.

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5. Komponenterne og deres afstamning.

Betegnelse	Køn	Oprindelses	Herkomst	Antal træer i plantagen 1946	1974
V 7o2 træ 1	♀	Formentlig dansk lokalrace	Stenderup, Nørreskov afd. 12	8o	2o
V 7o3 - 2	♀	lokalrace	Stenderup, Nørreskov afd. 1o	8o	2o
V 7o4	♀	-	Boller, Nederskov afd. 3o	4o	1o
V 71o	♀	-	Tåsinge, Horse skov afd. 5	4o	1o
V 791	♀	-	Sorø I, Broby Vesterskov afd.63a	8o	2o
V 792	♀	-	Sorø II, St. Bøgeskov afd. 67a	2o	9
V 793	?	-	Sorø II, Ll. Bøgeskov afd. 82a	8o	2o
V 797,træ 1	♂?	-	Hørsholm, Stasevang afd. 274	4o	1o
V 869	♀♂	-	Svenstrup, Dalby afd. 23a	4	o
V 894	♀♂	-	Bregentved, Grevinde afd.9o	4	o
V 895	-	-	- - 112	2	o
V 896	?	-	Bregentved "jubilæumsask"	5	o
V 898	♂?	-	Svenstrup, Kimmerslev afd. 11	2	o
V 282 træ 44	♂	-	Stenderup, Nørreskov afd.12	5oo	122
			Ialt	977	241

6. Forventninger til frøplantagens afkom.

1. Udgangspopulationens niveau: Bevoksninger over middel.
2. Plustræudvalgets forventede effekt: Usikker i en så stærkt kårpåvirkelig art.
3. Forventet heterosiseffekt: Ingen-ringe, event. proveneinshybrid-effekt.
4. Forventet kombinationseffekt: ?

Maj 1976
H. Barner

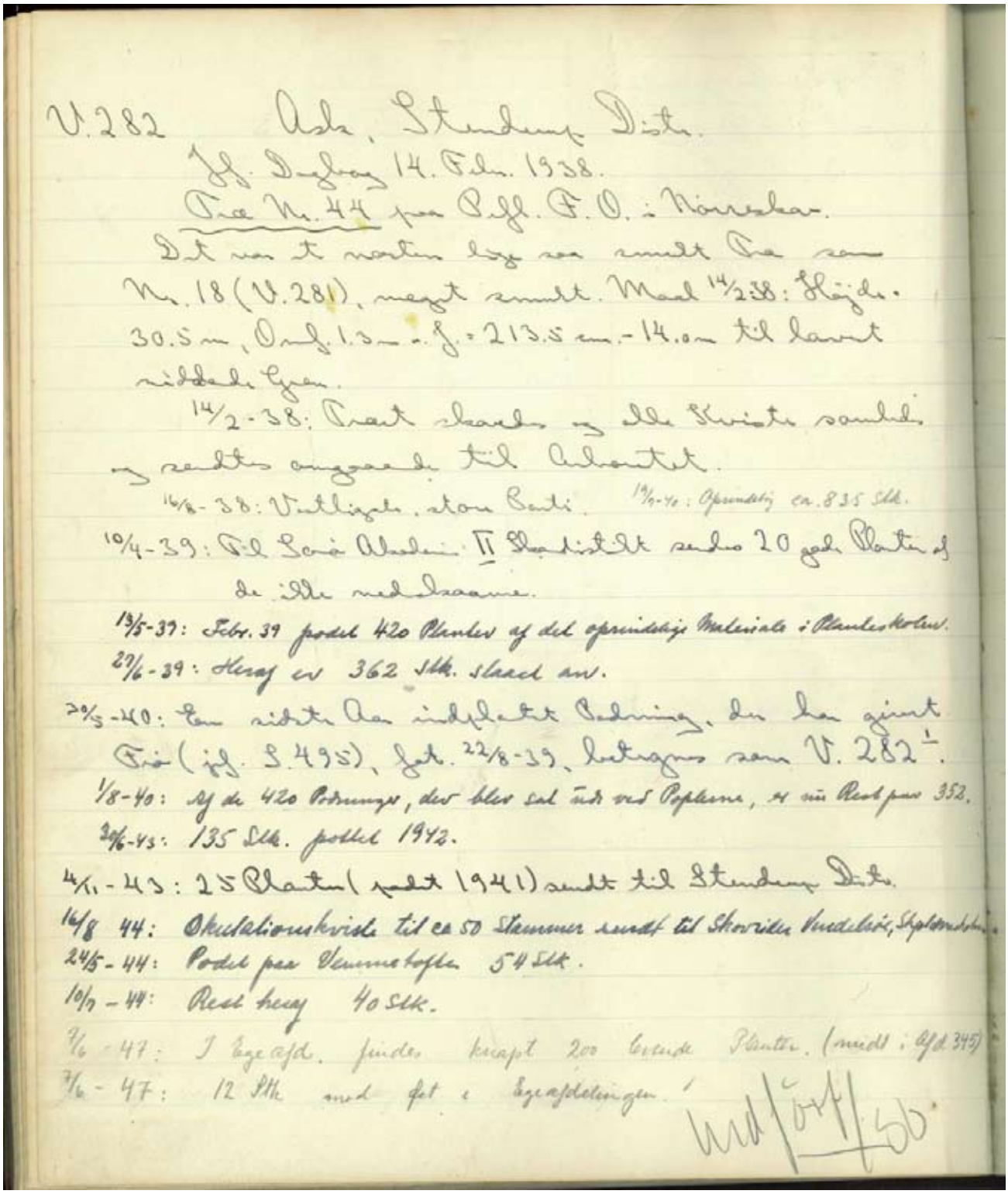
STATSSKOVENES PLANTEAVLSSTATION
HUMLEBÆK

Denne proveniensmeddelelse afløser den tidligere udsendte proveniensmeddelelse nr 7 af september 1963, der bedes udtaget af samlingen.

Appendix 3: Selection and propagation of clones in FP202 (1938-1944)

Source: Scanned copies of original registrations made during1938-1944. Unpublished records kept at Forest and Landscape, Faculty of Life Sciences, University of Copenhagen.

V282-1



V.282 Ask. Stendung Dito.

Jf. Dagbog 14. Febr. 1938.

Frø Nr. 44 fra Pilj. F.O.: Norrskar.

Det var et vartan lag som smelt Frø som Nr. 18 (V.281), meget smelt. Mand 14/2 38: Højde. 30.5 cm, Omfg. 1.3 m - f. = 213.5 cm. - 14.0 m til laveste nitdele Gren.

14/2-38: Frøet skaldes og alle Skviste samlede og sendtes omgaaende til Arboretet.

16/8-38: Vintlighed. stom Bunti. 19/9-40: Opmaalt ca. 835 Stk.

10/4-39: Til Sorø Akademi II Skodistikk sendes 20 gode Planter af de ikke medtaagne.

13/5-39: Febr. 39 podet 420 Planter af det oprindelige Materiale i Planteskolen.

27/6-39: Heraf er 362 Stk. skaaret av.

20/5-40: Den sidste Aar indplantet Sedning, der har givet Frø (jf. S. 495), fgt. 22/8-39, betegnes som V. 282½.

1/8-40: Af de 420 Podninger, der blev sat ud ved Poplerne, er nu Rest paa 352.

30/6-43: 135 Stk. podet 1942.

4/11-43: 25 Planter (podet 1941) sendt til Stendung Dito.

16/8 44: Okulationskvist til ca 50 Stammer sendt til Skovrider Vindeløv, Skjoldenholm.

24/5-44: Podet paa Stammetræer 54 Stk.

10/7-44: Rest heraf 40 Stk.

7/6-47: I Egeafd. findes knapt 200 levende Planter. (middl. Afd. 345)

7/6-47: 12 Stk med fat i Egeafdelingen.

Gra N. 44.
Fot. fra Syd.
14. Februar 1938.

Foraar 1941: Podet 778 Stk. af Autrodils Materiale og plantet direkte paa Vidler,
P.J. Sørjes. Gennemgaaet Juli 1941 af Nykolaw, 19 Stk. ikke slaaet op.
12/11-41: 480 Stk. maalt med Middelhøjde 26.2 cm, største Højde 100 cm.
21/11-41: Planter opgravet og sorteret.
203 Stk. smukke, rette til Opplantning
150 - med enkelt Sving - -"-
235 - til Moderkvister
142 - til Podning
15 - kasseret
+ 14 - kasseret paa Marken? (formen de tidligere af Nykolaw kasseret)

V. 702. ♀ Rek,

Slenderup Bøgeskov Afd. 10, Tra kv. 1.

26/1-44: Materiale hentet af E. Magnus, der beskriver Træet: „Totalhøjde 29.3 m, Bulhøjde 15.0 m, Diam. 0.60 m (ifølg. Skr. Larsens Maalinger). Træet har vært jævnt og rigeligt besat med Frøgler af hvilke en Del endnu sad tilbage og var temmelig fast. Endvidere Træet ved Hjælp af S.F.F.'s Stige og klippede med Stangsaks Materiale til 2-300 Podekvisle og af de nedklippede Grene indsamledes en Frøprøve.".

Skitse i Magnus Beretning S. 2.

1/4-44: 1000 Korn-Vægt = 76.25 g.

7/3-44: Podet i Hus 12 Stk.

1/7-44: Rest 10 Stk.

24/5-44: Podet paa Vemmetofte 32 Stk.

10/7-44: Rest 22 Stk.

26/5 45: Podet i Egeafd. 20 Stk.

7/6 47: Rest 13 Stk.

5/11-49: Træet fældet i Storm (meddelt af Fr. Larsen).

Udført/50

V. 703. ♀ Ask,
Slendemp Rørreskov Afd. 10, Træ Nr. 2.

26/1-44: Materiale hentet af E. Magnus, der skriver:
„Totalhøjde 28.2 m, Bukhøjde 14.8 m, Diam. 45 cm
(Skr. Lauens Maalinger). Ogsaa dette Træ har haft
jævnt og regelrigt Frø, men her var ikke set meget
tilbage og det var meget løst, saa det meste falder
af, naar Grenene falder til jorden.".
Skitse: Magnus Beretning S. 2.
1/4-44: 1000-Korn Vægt: 76.25 g.

6/3-44: Podet: Hvis 13 Stk.
1/7-44: Rest 10 Stk.

24/5-44: Podet paa Vemmetofte 30 Stk.
10/7-44: Rest 21 Stk.

26/5 45: Podet: Egeæble 20 Stk.
7/6 47: Rest 8 Stk.

Ud/ort/60

V704 (1)

V. 704. ♀ Ask,

Boller Nederskov, Afd. 30.

30/1-44: Materiale hentet af E. Magnus, der skriver:
„Totalhøjde 23.0 m. Akshøjde 18 m, Bukhøjde 15 m. Omkr. 1.3 m o.j. 112 cm. Et meget smukt Træ. Stammen næsten fuldstændig ret, Kronen velformet, men ikke ret stor. Kun meget lidt Frø, som havde siddet jævnt fordelt over Træet. ..... Træet var uden Frostrevner, men ved at stamme sat en del nydig frembrøde Vanris. . ."
Skitse og Foto i Magnus Beretning 5.6.44.

1/4-44: 1000 Korn Vægt: 98.0 g.

9/3-44: Podet i Hus 12 Stk.
1/7-44: Alle i Live.

24/5-44: Podet paa Vemmetofte 29 Stk.
10/7-44: Rest 27 Stk.

19/5-47: Paa et Møde i Botanisk Forening blev følgende registreret:
V. 704¹ (Sjæl. Plante) varmt en ♀ med meget rudimentær ♂.
V. 704³ (en nordl. Plt.) ♂ og ♀, men kan maaske give Frø, gav vaglagt Pollen, lille a. ren Dansk af ♂.
Begge disse Planter har været isoleret i god Tid.

V704 (2)

og synes at udvikle sig. Gjem de Frø er det
enten Selvbestøvning eller Frø uden Befruvning.

26/5 45: Podet i Lergryde 20 Stk.
7/6 47: Rest 14 Stk.

indført 1950

V710

V. 710. ♀ Ask, Alt. 5
Horse Skov V, Tåsinge.
Valdemarslot D.

14/2-44: Materiale hentet af E. Magnus, der skriver:
„Totalhøjde 21 m. Bålhøjde .... Akshøjde 12.3 m.
Omf. 78 cm. Stammen ikke helt ret, men uden
Frostrivner. Kronen velformet, jævnt og sigelig bevart
med Frø. Træet staar i en Bevoksning med mange
meget smukke Ask, som dog forhindrer synes at være
Haar Træer. Entreds Træet ved Hjælp af Jernstiger
og klippedes med Stangsaks Materiale til ca. 300 Podd-
kvisle og indsamlede Frøpriser af de nedklippede Grene."

1/4-44: 1000 Korn Vægt: 100.0 g

6/3-44: Podet i Kris 12 Stk.
1/7-44: Rest 12 Stk.
-44: -"- 10 -"-

24/5-44: Podet paa Vemmetofte 38 Stk.
10/7-44: Rest 32 Stk.

Foraar 45: Podet paa Vemmetofte 15 Stk. (Ompodning)

26/6 46: 20 Stk podet i Egeaafd.
7/6 47: Rest 15 Stk.

Ved fort 60

V791

V. 791. Ask,
Broby Vestermoor, I Sorø, Afd. 63 a

20/3-44: Podet: Hvid 10 sek.
1/3-44: Indet: Lyse.

Ind for A/80

V793

V. 793. Ask, „Frøask"
Lille Bøgeskov Afd. 82a, Prøf. FKa
Indsamlet og Fol. 22/3-1944.

24/5-44: Podet paa Vemmetofte 34 Stk.
10/7-44: Rest 27 Stk.

24/5 45: Podet i Egeæsel 20 Stk.
7/6 47: Rest 16 Stk.

indforl/80

V797

V. 797. Ask Nr. 1

Steuerwang, Harskolm Distr.

20/3-44: Podet i Hus 13 Stk.
1/7-44: Rest 11 Stk.

24/5-44: Podet paa Vemmetofte 30 Stk.
10/7-44: Rest 12 Stk.

ind/Sort/80

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