

## BOTANY

VEGETATIVE PROPAGATION OF *POPULUS* CUTTINGS FROM  
SOUTH AFRICA IN SPRING IN THE NETHERLANDS

BY

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The breeders of *Populus* in The Netherlands are interested in the possibility of vegetative propagation in this country of species and strains of this genus that are introduced from the southern hemisphere. Cuttings to this purpose have to be taken (see below) in the early autumn of South Africa after growth has stopped for the season, preferably of ripened or half-ripened wood. Such cuttings, if sent by airplane, arrive in April-May in late spring of The Netherlands. If, then, they would shoot and root rapidly, time at least will not be the limiting factor for the new shoots to ripen before the onset of the autumn frosts. To this purpose shooting and rooting should be satisfactory by the longest day of the year, June 21st.

The problem has been put before us by Dr G. HOUTZAGERS, Professor of Forestry in Wageningen, by whose request the cuttings have been provided by The Lion Match Company Ltd Industria at Johannesburg, Transvaal, and have been sent from Langlaagte, Transvaal.

It will be obvious that some research work was needed before a suitable method could be developed. It was a lucky circumstance that we were confronted with the problem in April 1951 as it left us a whole year for preliminary work. This has been performed partly on what might be called "artificial" South African cuttings. To this purpose Dutch trees of *Populus* were grown since May 1951 with a short-day of 9 hours as the genuine ones would come from a rather short-day climate. Control trees received the natural long day of The Netherlands.

In autumn 1951 and early spring 1952 cuttings were taken from both kinds of these Dutch trees and cultivated in various conditions of dormancy, light, temperature and humidity with or without growth hormone treatment. So experiments were done with cuttings in a state transitional between preliminary rest and middle rest and in the state of afterrest. The results of this work are being published [3] and [4].

The best treatment of the cuttings in both stadia of rest appeared to be 14 days of darkness at 20°-22° C in a room with relative humidity 75 %, prior to the normal cultivation in the greenhouse, where, day length in the Dutch autumn and early spring being short, the day has been lengthened up to 16 hours by means of TL light (see further l.c.).

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The cuttings might not be grown in a short day, for the "genuine" cuttings from South Africa in our country in late spring and summer would find long days.

Several pretreatments prior to planting in the darkroom had been tried and as a result breaking of dormancy by hot water followed by growth hormone application could be recommended for best shooting and rooting [4]. Nevertheless, with the South African cuttings some other treatments have been tried as well for reasons to be mentioned.

It is a well known fact that artificial reviving of growth in trees during or towards the period of deep rest is difficult or virtually impossible. Consequently our choice with regard to the arrival of the South African cuttings was either during preliminary rest or at the moment of transition to middle rest. We could also had them sent by request during afterrest, but in that case the afterrest period would have got to be shifted in South Africa to an earlier date (see REINDERS-GOUWENTAK [3]). This being expensive and elaborate we had asked for the cuttings to be taken and sent a week before the shedding of the leaves, so that they would be no longer "softwood" cuttings but not yet quite "hardwood" ones. For the use of these terms see AVERY and JOHNSON [1].

The cuttings have been delivered for transport in Johannesburg May 14th, but due to a stagnation of airplane services they did not arrive in Wageningen until May 26th. Because of this considerable delay the above mentioned hot water treatment for dormancy breaking has been substituted by a night exposure to ethylene chlorohydrin vapor as in our opinion this method has the stronger effect that would be needed towards the commencement of middle rest. The cuttings have been sent as *Populus deltoides*; according to Professor HOUTZAGERS the name must be *P. deltoides angulata*. As will appear from the results stated they had already left the preliminary rest proper. Yet, at the time fixed (21st June), they still responded for 50 %, 22 out of 44 cuttings in the best experimental set shooting by that date, a figure which in all experiments of this kind would be satisfactory.

As it was not known whether the state of rest of the South African cuttings would differ from the state of rest preliminary work had been concerned with or otherwise would show a different response to treatments, it was decided to try as many treatments as could be applied without too much diminishing the number of individuals per set. It was thought that in this case a number of 40 cuttings per group was the minimum advisable. This brought the possibility of treatments at four.

The procedure followed was: pretreatment for dormancy breaking and stimulation of rootformation in the 4 combinations possible, planting in a mixture of peat and sand 1 : 1, after that a period of 14 days in darkness at 20°-22° C with a relative humidity of 75 %, then cultivation in the normal greenhouse in the natural long day lengths of the Dutch spring.

For rest breaking treatment was chosen our former procedure with vapor of ethylene chlorohydrin overnight (GOUWENTAK [2]) as the hot water treatment though effective during afterrest has not been yielding quite satisfactory results with the Dutch poplar cuttings in the transitional state between preliminary rest and middle rest and a stronger method seemed advisable now that the South African cuttings could be expected to be in the same state of rest. For growth hormone treatment the cuttings were soaked overnight in a solution of 60 p.p.m. of the sodium salt of indole-3-acetic acid, 300 cm<sup>3</sup> of the solution being used for each set of 40 cuttings.

The best results were recorded with set (a), after breaking of dormancy and subsequent growth hormone treatment. The other sets are (b): dormancy broken, no growth hormone treatment, (c): dormancy not broken, growth hormone treatment, (d): controls. The results on the 21st June for the various sets are:

(a): 22 out of 44 cuttings had developed growth, 19 of them bearing shoots of 10 cm or more in length.

(b): 14 out of 48 cuttings, 4 of which only with shoots of about 10 cm in length.

(c): 23 out of 40 cuttings, 7 of which with such large shoots.

(d): 12 out of 40 cuttings, 3 of which with such shoots.

So shooting response in both of the sets (c) and (a) on the 21st June is 50 %. On June 28th after one month of growth, the figure for (c) became 60 % and for (a) 55 %. Yet, this does not mean a similar effect of both of the treatments with regard to speeding up bud growth as on the latter date only 20 % of the total of the cuttings which had shooted in set (c) bore shoots of any useful length, a figure which in set (a) was outrun with 80 %.

So we may conclude that for the South African cuttings at the beginning of middle rest the best procedure of the various treatments tried and on the whole a good one for speeding up bud growth is breaking of dormancy and growth hormone treatment followed by a stay for 14 days in darkness prior to normal culture conditions.

Root formation has not been checked until September 1st after 3 months of growth. By that time some of the cuttings in each group had died either without having formed a shoot or with only a very short one, or they had not rooted. This left in subgroup (a): 35 out of the 44 (= 80 %), in (b): 26 of the 48 (= 55 %), in (c): 31 of the 40 (80 %), in (d): 24 of the 41 (= 60 %) cuttings the experiments had been started with.

From these figures it appears that many of the cuttings in all of the groups in which the buds were still dormant by the end of June had opened their buds later in the season. Yet, not all of these cuttings were useful due to insufficient root formation. In figure 1 root formation is demonstrated with 5 different qualifications for rooting response. If the

cuttings which deserve qualification 1 or 2 are omitted, their shooting response mostly being also insufficient, the following numbers in the various sets are left:

- (a): 27 or 61 % of the original number
- (b): 23 or 48 %
- (c): 27 or 67 %
- (d): 18 or 44 %

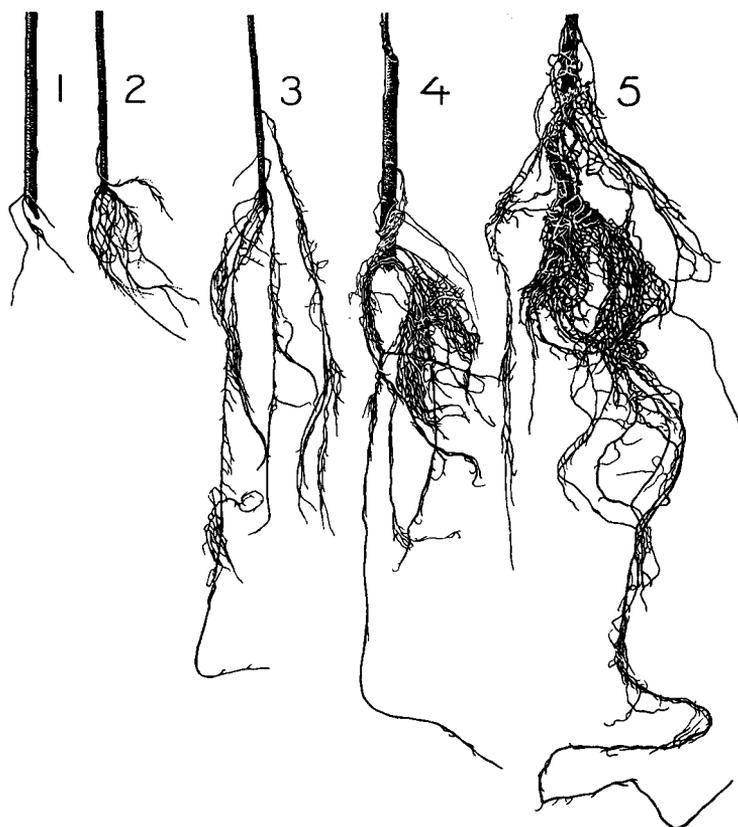


Fig. 1. *Populus deltoides angulata*. Classing of the rooting response of the cuttings after three months of growth.

Many of these cuttings of set (c), i.e. 11, have got to be qualified with figure 3, the numbers for sets (a), (b) and (d) are respectively 6, 2 and 1. As the average shootlengths for the various sets on the same date including the cuttings with root figure 3, are (a): 31 cm, (b): 29 cm, (c): 27 cm and (d): 27 cm preference from a physiological point of view has to be given to the treatment of set (a) with regard to both shoot development and rootformation. If the sets (b), (c) and (d) are compared to (a) there is only a small difference between the shootlengths, and rootformation in all sets is also very similar with the exception of the rather large number of cuttings with root figure 3 in (c). So all sets did

satisfactorily in this special case. This is due to the fact that growth was not slowing down until the short October days, thus giving a chance for growing to those buds of set (b), (c) and (d) that bursted as late as August, at a time when Dutch poplar trees had ceased growth in length and were forming end buds.

If, however, special measures are taken for the promotion of end bud formation by giving short day lengths as soon as bud burst commences or shortly afterwards and in any case long before the beginning of August, it will be clear that only those cuttings that by that time have developed shoots of any length are suitable to be treated with short days. From the results on June 21th it appears that these are the cuttings of set (a). So breaking of dormancy and growth hormone application surely is best for treating of cuttings in the commencement of middle rest if the cuttings are coming from climates with shorter days in spring and summer than are prevailing in The Netherlands.

### *Summary*

A method has been developed for the treatment of poplar cuttings from South Africa in the Dutch spring. Best for bud development and rootformation is a treatment prior to planting out including dormancy breaking with ethylene chlorohydrin, growth hormone application and about two weeks of growth in complete darkness.

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