A note on Dwarfing of Pinus patula grafts

By W. G. Dyson[1])

(Received February 1975)

The East African tree breeding Programme, which is coordinated by the East African Agriculture & Forestry Research Organization, includes the establishment of grafted clonal seed orchards of Pinus patula Schiede et Deppe and orchards planted at Sao Hill in Tanzania are now bearing substantial crops of seed.

The grafts for these orchards were made on potted stock in Muguga and Lushoto Forest nurseries in 1966 and 1967 by the tip-cleft method, using fast growing branch tips from the "plus" ortets. In the nursery, the highest proportion of successful unions is obtained when the most vigorously growing stock plants available are used (May 1961) and, for this reason, most of the 1966 plants were grafted on Pinus radiata D. Don stocks in preference to Pinus patula. During that year however, it was noticed that while the interspecific grafts were easy to make in the nursery, subsequent growth of P. patula scions was slower on P. radiata stocks than on root-stocks of their own species and the use of radiata stocks for *P.* patula grafts was stopped. The Sao Hill orchards consequently contain a mixture of stock species and twenty-one P. patula clones are represented by varying numbers of ramets on both patula and radiata stocks. By mid 1972, 5 years from planting, it was obvious that a large proportion of the ramets on radiata stocks had a dwarfed, bushy form but appeared to be bearing more ripening cones than grafts made on patula stocks.

In an attempt to quantify this effect, the height and diameters of surviving ramets wcre measured in August 1972, the yield of cones and weight of seed extracted were recorded separately by clones for the December 1972 and 1973 crops. In March 1974, an assessment was made of the stock species, stem form and crown form of all surviving ramets. Stem and crown forms were scored in five and four grades respectively as follows:

Stem Form		Crown Form	
Score		Score	
1.	Stcm perfectly straight and erect	1.	Regular, finely branched
2.	Slight defect — usually sweep	2.	Regular, but thicker branches
3.	Stem markedly crooked	3.	Irregular, coarse branching
4.	Butt log would need cross-cutting before it could be sawn	4.	Bushy dwarf form
5.	No utilizable logs obtainable		

Grafting effects on Growth

The overall effects of the two stock species of the growth and form of the ramets are summarized in table 1.

Of the twenty five Pinus patula clones included in the orchards, all except one (K. 211) show some degree of dwarfing caused by graft incompatability on radiata stocks. Apart from manifestly dwarfed trees, other grafts on *radiata* stocks have shorter, thinner stems and are more crooked with less regularly branched crowns than ramets of the same clone grafted on patula stocks.

[1]) Tree Breeder, East African Agriculture & Forestry Research Organization, Muguga Kenya.

Effects on Seed Yield

The second substantial crop of cones from the Sao Hill orchards was harvested in December 1973, 6½ years after planting. The number of cones collected, the weight of seed extracted and the germination capacity of samples of the seed, were recorded for each clone separately. Because the data had been recorded by clones, it was not possible to assess the effects of the stock species on all ramets of all clones, but partial comparisons could be made. The mean yield of cones per ramet for 25 clones was compared by regression with the proportion of each clone grafted on radiata stocks but no significant relationship could be found. Mean cone and seed yields from 73 ramets representing 17 clones grafted on patula stocks and from 154 ramets representing eight clones on radiata could be extracted from the data and are compared in table 2. It will be seen that ramets grafted on radiata stocks produced very slightly fewer cones with a slightly higher seed content than those on patula, but the differences are not statistically significant.

The use of special stocks, often of a different species or variety from the scion, has long been practiced in fruit orchards (Gardner et al., 1922) to reduce the stature of the grafts and to encourage early fruiting. The observations reported above suggest that a similar effect has occurred in *Pinus* patula grafts made on P. radiata stocks. It remains to be seen if the heterospecific grafts will live long enough for the technique to be of practical value.

The adjoining photograph shows a severely dwarfed ramet of clone K37 on a P. radiata stock bcaring 18 month old cones.

Acknowledgements

Much of the data discussed in this note was collected by Mr. J. K. Sige, Asst. Forester (Silviculture), Sao Hill. Mr. A. R. Sayers and Mr. G. K. Karanja of E.A.A.F.R.O. helped with analysis of some of the data. This note is published with the permission of the Director, E.A.A.F.R.O.

Summary

A grafted seed orchard of Pinus patula Schiede et Deppe, planted at Sao Hill, Tanzania in 1967, includes both heterospecific grafts of Pinus patula scions on Pinus radiata D. Don stocks and homospecific grafts. Later it was noticed that many heterospecific grafts were dwarfed in stature. Measurements made in 1974 confirm that 38% of the hetero-specific grafts are conspicuously dwarfed and the remainder show reduced height and diameter growth and impaired stem and crown form. Upto 1973, there were no significant differences in seed yield from the two kinds of grafts.

Key *words:* Heterospecific grafting, ***Pinus patula*** Schiede et Deppe, ***Pinus radiata D. Don,*** Seed-Orchards.

Zusammenfassung

Zur Erstellung von sog. Samenplantagen der Kiefern-Art Pinus patula Schiede et Deppe in Sao Hill, Tanzania, wurden in den Jahren 1966 und 1967 Reiser von Pinus patula-Plusbäumen auf Pinus radiata D. Don-Unterlagen, jedoch zugleich auch auf Unterlagen der eigenen Art Pinus patula gepfropft. Danach wurde beobachtet, daß die Pinus patula-Pfropflinge auf P. *radiata*-Unterlagen langsam-wüchsiger waren als auf den Unterlagen der eigenen Art, wobei gleichzeitig ein erhöhter Zapfenbehang festgestellt werden konnte. Die Untersuchung im Herbst

Table 1. — Growth of *Pinus patula* grafts in seed orchards at Sao Hill, Tanzania.

Character Assessed	Stock species	
	Pinus radiata	*Pinus patula*
Number of grafts surviving	318	253
Proportion of number originally planted	78%	80%
Mean Height (aged 5yr. 4 months)	4.17 m	6.98 m
Mean breast Ht. Diameter (5yr. 4m.)	6.35 cm	11.20 cm
Mean Crown Form Score (aged 6yr. 11m.)	2.76	2.17
Mean Stem Form Score (6yr. 11m)	3.54	1.77
Number of stems manifestly dwarfed	120	6
Proportion of surviving grafts dwarfed	37.7%	2.4%

Figure 1. — A dwarfed ramet of *Pinus patula*, clone K. 37, grafted on 2 *Pinus radiata* stock aged 6½ years. Note typical swelling of the upper part of the stock and abundant maturing cones on the Scion.

Table 2. — Seed Yield of *Pinus patula* Grafts at Sao Hill, Tanzania.

	Stock species	
	Pinus radiata	*Pinus patula*
Number of clones represented	8	17
Number of ramets	154	73
Mean No. of cones/ramet	22.6 ± 6.2	22.4 ± 5.0
Mean Wt. of seed/cone	118 ± 16 g	168 ± 30 mg
Germination capacity	72%	68%

1973 auf Höhen- und Durchmesserwachstum, Kronenform, Zapfenbehang usw. ergab z. T. erhebliche Wachstumsunterschiede, jedoch bis dahin noch keine signifikanten Unterschiede in der pro Pfropfling geernteten Samenmenge. Die Untersuchungen werden fortgesetzt.

References

1. May, W. B.: A technique for grafting conifers in the field in East Africa. E. Afr. agric. For. J. 27 (1): 20—21 (1961) — 2. Garner, V. R., Bradford, F. C. and Hooker, H. D.: Fundamentals of Fruit Production. MacGraw-Hill, New York, p. 552—579 (1922).