

**VARIATION OF STEM VOLUME AND WOOD DENSITY OF
PROVENANCES OF *Pinus oocarpa* AND *P. patula* SSP. *tecunumanii* AT
AGUDOS, SÃO PAULO, BRAZIL**

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ABSTRACT - A provenance trial of ***Pinus oocarpa*** Schiede / ***P. patula*** Schiede and Daphe ssp. ***Tecunumanii*** (Eguiluz and Perry) styles of the International series coordinated by the Oxford Forestry Institute, University of Oxford, England, was established at Agudos, São Paulo, Brazil, in 1972. In 1979, the trial was assessed for wood density (DEN) and volume under bark (VUB) and these two traits plus the derived indices of within sample density variation (VAR) and dry matter index (DMI) were analyzed statistically, there were significant differences ($p < .01$) between provenances for VAR, VUB and DMI. Provenances of ***P. patula*** ssp. ***tecunumanii*** were superior to provenances of ***P. oocarpa*** in terms of VUB and DMI.

RESUMO - Em 1972 foi estabelecido em Agudos, São Paulo, Brasil, um ensaio de proveniências de ***Pinus oocarpa*** Schiede e ***P. patula*** Schiede e Deppe ssp. ***tecunumanii*** (Eguiluz e Perry) Styles segundo a Série Internacional coordenada pelo Oxford Forestry Institute, Inglaterra. Em 1979, estimaram-se a densidade da madeira (DEN) e o volume sob casca (VUB) e foram analisadas estas duas características, bem como os índices derivados da variação da densidade dentro da amostra (VAR) e o índice de matéria seca (DMI). Encontraram-se diferenças estatisticamente significativas ($p < 0.01$) entre as proveniências para VAR, VUB e DMI. As proveniências de ***P. patula*** ssp ***tecunumanii*** mostraram-se superiores às proveniências de ***P. oocarpa*** em termos de VUB e DMI.

INTRODUCTION

Commercial plantations of ***Pinus oocarpa*** Schiede were first established in Brazil in 1960 (Nicolielo and Garnica, 1983). This species is now one of the most important pine species used for afforestation in Brazil especially in the states of Sao Paulo and Minas Gerais (Kageyama et al., 1977).

Seed orchards of ***P. oocarpa*** have been established using selections made in the older plantations and provenance trials have been established at several sites in Brazil. This paper concerns data from a provenance trial of ***P. oocarpa*** planted at Agudos, Sao Paulo, Brazil, in 1972, as part of the International Series coordinated by the Oxford Forestry Institute (OFI), University of Oxford, England.

MATERIALS AND METHODS

The Agudos site is located at 22° 22' S with an elevation of 550m and a mean annual temperature and precipitation of respectively 21.1°C and 1300 mm. The trial

consists of four blocks of twenty-five tree plots at a spacing of 3x3m and a subplot of sixteen trees were measured in this assessment. Provenance details for **P. oocarpa** are summarized in Greaves (1979). Three of the **P. oocarpa** provenances represented in this trial have been identified as **P. patula** Schiede and Deppe ssp. **tecunumanii** (Eguiluz and Perry) Styles (McCarter and Birks, 1985). Details of provenances country of origin and abbreviations used in this trial are summarized in Table 1.

The trial was assessed in 1979 and increment cores of 8 mm diameter were taken bark to bark at breast height from the three largest trees in each measured plot in each provenance in each block. The increment cores were prepared for densitometry using the methods described by Wright et al. (1986). Kanowski (1985) has described the procedures used at the DFI with respect to densitometry. In addition to mean density (DEN), data from the densitometer Can also be used to calculate within sample density variation (VAR): Volume under bark (VUB) was determined for each of the trees sampled for DEN using under bark diameter at breast height, total height and a form quotient based on the outside diameter at breast height and at 6 m (Gibson et al., 1983). The dry matter index is the product of DEN and VUB.

The analysis of variance was applied to data for DEN, VAR, VUB and DMI. Differences between provenances were tested at the 5% level using the Q statistic as described by Chew (1977).

Table 1. Details of provenances, country of origin and abbreviations for *P. oocarpa* and *P. patula* spp. *Tecunumanii* provenances at Agudos, São Paulo, Brazil.

SPECIES	PROVENANCE	COUNTRY	ABBREVIATION
P. oocarpa	Angeles	Honduras	ANG
	Bcaral	Guatemala	BUC
	Huehuetenango	Guatemala	HUE
	Lagunilla	Guatemala	LAG
	Lima	Guatemala	LIM
	Pueblo Caido	Guatemala	PUE
	San Jose	Guatemala	JOS
	San Marcos	Honduras	MAR
	Siguatepeque	Honduras	SIG
P. Patula	Zapotillo	Honduras	ZAP
	Camelias	Nicaragua	CAM
	Mountain Pine Ridge	Belize	MPO
	Rafael	Nicaragua	RAF

RESULTS AND DISCUSSION

The results of the analysis of variance are summarized in Figure 1. Provenances were significantly different ($p < .01$) for VAR, VUB and DMI. The Q statistic exceeded the range for DEN and has been omitted for this trait.

The **P. patula** ssp. **tecunumanii** provenances Camelias, Mountain Pine Ridge and Rafael were superior in terms of VUB and DMI to provenances of **P. oocarpa** but were ranked below the trial mean for DEN with the exception of Camelias. The superior volume production of the **P. patula** ssp. **Tecunumanii** provenances was observed in this trial

during a previous assessment (Kageyama et al., 1977) and similar results have been found in Kenya (Wright et al., in preparation) and Ecuador (Wright et al., in preparation). The **P. oocarpa** provenances Siguatepeque and Zapotillo were ranked below the trial mean for DEN, VUE and DMI and this indicates that slow growth is not necessarily associated, with increased density.

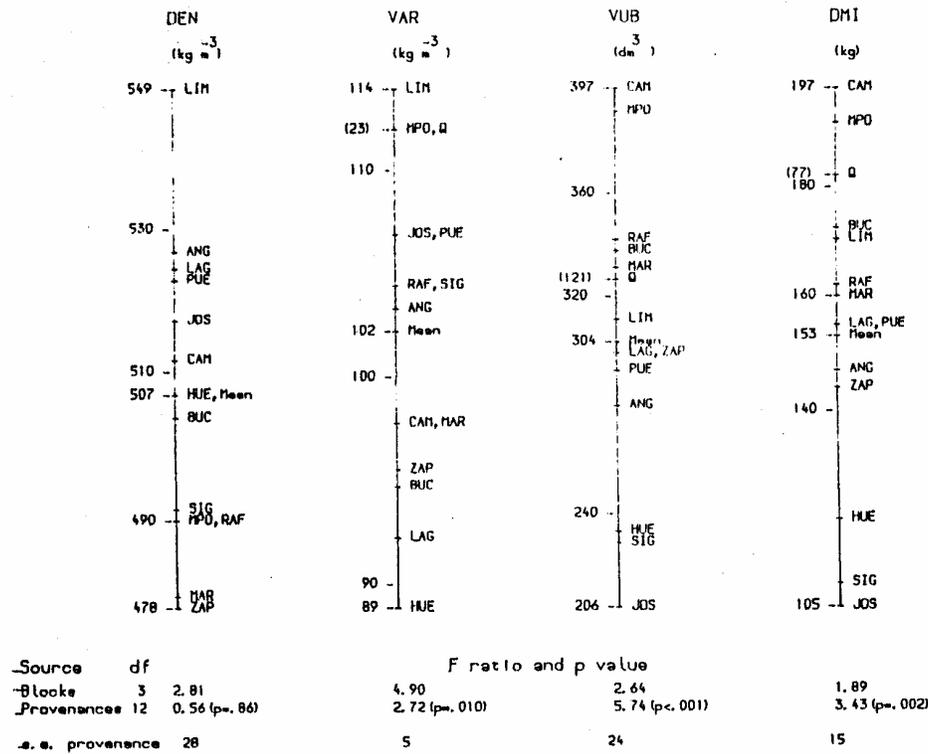


Figure 1. Analysis of variance, ranked means and the critical difference, Q, at the 5% level for densitometric density (DEN), within sample density variation (VAR), volume under bark (VUB) and dry matter index (DMI) of *P. oocarpa* and *P. patula* spp. Tecunumanii provenances at Agudos.

The density of plantation-grown trees of ***P. oocarpa*** has been shown to exceed the density of certain pine species commonly planted in Brazil, notably ***P. elliottii*** Engelm., ***P. patula*** Schiede and Deppe and the three varieties of ***P. caribaea*** Morelet (Ferreira and Kageyama, 1977). Despite the lack of statistically significant differences between provenances in this trial, and its older age, the mean DEN, 507 kg/m, is even higher than the value, 450 kg/m, determined by Nicolielo and Garnica (1983) for wood samples taken in a thirteen-year-old plantation of ***P. oocarpa***.

ACKNOWLEDGEMENTS

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