

INTENSIVE ROOT WRENCHING: A PREREQUISITE FOR THE SUCCESSFUL ESTABLISHMENT OF 1-0 PINUS CARIBAEA MOR. SEEDLINGS

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Pinus caribaea Mor. is widely recognized as the premier planting species for tropical and subtropical lowland afforestation schemes (2). Without exception, all planting authorities utilize container-raised planting stocks, a consequence of the poor survival potential of untreated open root seedlings (1). Since containerization can add substantially to open root establishment costs, for example a six-fold increase is recorded in Queensland, a simple method of preconditioning 1-0 seedlings to withstand the nursery-field transplant stress was sought.

Obviously, a more severe preconditioning regime was needed and a further series of trials was established testing more intensive root wrenching schedules. The costly heeling-in operation was abandoned. Treatments comprised weekly, fortnightly, and monthly wrenching from both sides of the drill to a depth of 8 to 15 cm. Wrenching commenced on an average of 16 weeks before out-planting. A clay slurry root dip treatment, applied immediately after lifting, was also included. Stock characteristics at lifting and subsequent field performance are summarized in table 1.

Successful field survival of 1-0 Caribbean pine seedlings depends on adequate preconditioning in the nursery. Intensive root wrenching regimes can provide the requisite treatment.

Experimental

Summer and winter planting trials were conducted at two Queensland coastal centers, Byfield (22° 55'S) and Beerburum (26° 45'S) respectively. Test plants were raised from drill sowings of locally improved var. *hondurensis* B. and G. seed, and hand planted on quality sites. Tubed stock (grown in 5 cm diameter by 20 cm tall lacquered iron tubes) served as controls.

In early preconditioning experiments, seedlings were subjected to occasional root wrenching (partial

root severance in *situ* effected by inserting an inclined flat-bladed spade from one side of the drill to cut the tap root at a depth of 20 cm) followed in some instances by heeling-in (transplanting within the nursery). These treatment regimes could not be relied upon to provide adequate field survival of 1-0 stock under other than exceptionally favorable planting conditions. Nevertheless, the degree of root disturbance afforded plants while in the nursery bed was seen to influence subsequent field survival (table 2).

Table 1.—*Effects of intensive root wrenching regimes on 1-0 seedling characteristics at lifting and performance after 2 years in the field*

Treatment	Nursery Phase		Field Phase		Height (cm)
	Height (cm)	Root ¹ Shoot	Survival percent ²		
			Roots Dipped ³	Roots Undipped	
Weekly wrenched	27.2	0.283	86	80	166
Fortnightly wrenched	28.6	0.221	80	76	164
Monthly wrenched	31.3	0.192	76	71	164
Tubed controls	23.1	0.475		97	180

¹ Oven dry weight basis.

² Unculled stock used. Summer (2) and winter (6) plantings recorded similar survival patterns and they have been combined for simplicity (c. 3600 plants/wrenching treatment). Testy weather conditions were encountered during establishment at both centers.

³ Roots dipped in a clay slurry immediately after lifting from the nursery bed.

Discussion

Intensive root wrenching schedules produce well proportioned 1-0 planting stock (fig. 1) with acceptable field performance potentials. The improved root development, at the expense of shoot growth, effected by the preconditioning regimes must be a major factor in promoting successful open root establishment. Field survival is also enhanced by the root dip application that provides an effective resistance to root desiccation.

The success of intensive root wrenching in preconditioning 1-0 Caribbean pine planting stock has been verified in subsequent large-scale, routine type trials at Beerburum. In these machineplanted trials preconditioning costs were minimized through the introduction of mechanized root wrenching methods and implements (3, 4) (fig. 2).

The present phasing-in of faster growing Caribbean pine in lieu of slash pine (*P. elliotii* Engelm. var. *elliotii* L. and D.) in southeast Queensland winter planting programs is a direct consequence of the development of a satisfactory low cost nursery preconditioning schedule. The prescription adopted for routine use calls for fortnightly root wrenching (using a tractor mounted horizontal reciprocating blade) at a depth of 13 cm, commencing when

seedlings attain a height of 15 to 20 cm, and interdrill cutting of lateral roots (using tractor mounted fixed vertical knives) at 6 weekly intervals. At lifting, roots are dipped in a clay slurry and stock are machine planted. The prescription would be slightly modified for adoption in more tropical areas where nursery height development is more difficult to control. For instance, root wrenching would commence a little earlier, and operate at weekly intervals with side cuttings made monthly. The preconditioning technique described in this note should have wide application and may provide a further impetus to an already expanding world-wide Caribbean pine planting program.

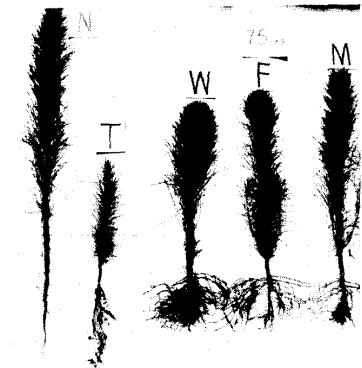


Figure 1.—Comparison of 9-month-old Caribbean pine seedlings ex Byfield nursery. N= unwrenched free growers; T= Tubed controls; W=Weekly root wrenched; F=Fortnightly root wrenched; M=Monthly root wrenched. Background grid shows 2 cm squares.

Table 2.—Early attempts at nursery preconditioning of 1-0 Caribbean pine and attendant field survival

Treatment	Survival percent ¹	
	Byfield	Beerburum
Single root wrench	37	58
Double root wrench	40	77
Triple root wrench	67	
Heel-in		48
Single root wrench -I- heel-in		74
Double root wrench -I- heel-in	30	82
Tubed controls	96	98

¹Culls (undersized, spindly, malformed) removed before planting. Pooled data (c. 600 plants/treatment/centre) from five experiments conducted in different years at each centre.

Acknowledgement

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Literature Cited

1. Bacon, G. J. and P. J. Hawkins.
1977. Studies on the establishment of open root Caribbean pine planting stock in southern Queensland. *Aust. For.* 40(3):173-191.
2. Lamb, A. F. A.
1973. *Pinus Caribaea*. Vol. 1. Fast Growing Trees of the Lowland Tropics No. 6. Commonwealth Forestry Institute, Oxford. 254 p.
3. Lott, J. R. and R. G. Hallman.
1973. New Zealand root pruner evaluated for U.S. use. *USDA For. Serv. Tree Planters' Notes* 24(4):18-20.
4. Van Dorsser, J. C. and D. A. Rook.
1972. Conditioning of radiata pine seedlings by undercutting and wrenching: Description of methods, equipment, and seedling response. *New Zealand J. For.* 17(1):61-75.



Figure 2.—Reciprocating root wrencher used for conditioning 1-0 pine planting stock in Queensland.