

*Vertical attachment ineffective*

# New Zealand root pruner evaluated for U.S. use

by  
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**M**any nurserymen prune the roots of seedlings in the beds to modify root and top growth, loosen soil, and facilitate lifting. Some nurserymen prune the seedlings horizontally only, while others prune both horizontally and vertically. If roots are to be pruned both horizontally and vertically, two passes are made over the beds, each with a separate pruning implement. A machine that prunes seedling roots horizontally and vertically on one pass is being used in New Zealand. During the spring of 1972, the Missoula Equipment Development Center evaluated a unit that functionally duplicates the New Zealand root pruner to see if it would be effective in U.S. nurseries.

## Equipment

The New Zealand root pruner comprises two separate implements that can be mounted on a tractor of about

50 draw bar HP with a category 2 hitch. The horizontal pruning implement (fig. 1), mounted on the hitch, undercuts the seedling bed with a reciprocating blade driven by the power take-off (PTO). The amount of soil disturbed can be controlled by varying the design of the blade and its angle into the bed.

The vertical pruner (fig. 2), mounted on the front of the tractor, consists of a series of rolling coulters attached to a frame that can be raised and lowered hydraulically. The

Coulters are individually castored and are free to move through an arc of 20 degrees. Spring steel shoes press down the soil around each coulters to prevent bed rollup. Neither of the New Zealand pruning implements can be purchased in the United States. The vertical pruner was

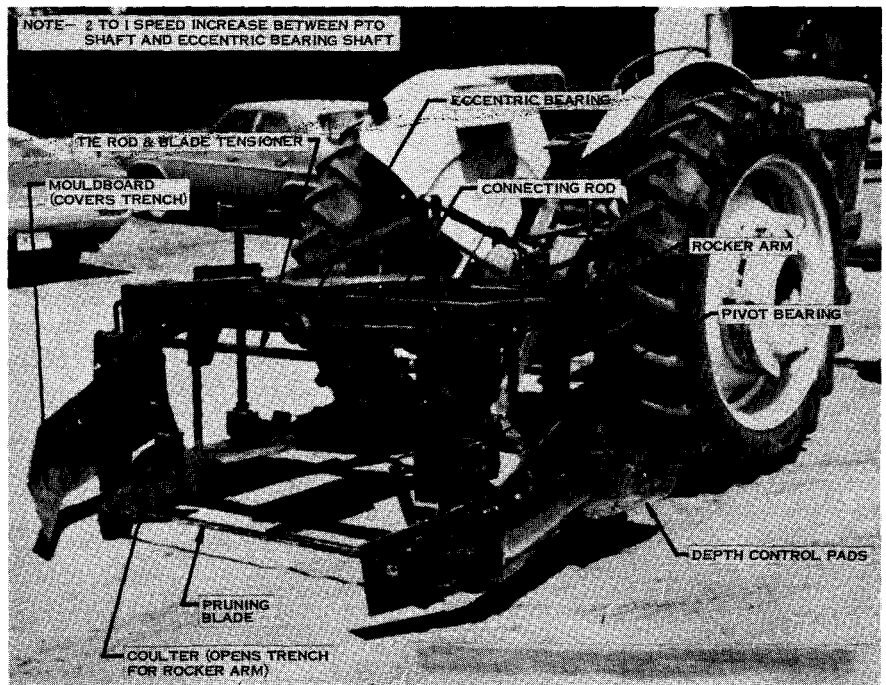


Figure 1.-Horizontal root pruner

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TABLE 1.—Nursery conditions at 10 test sites

Test No.	Date	Nursery	Soil classification	Soil moisture	Species	Age class	Seedling height	Seedling density (seedlings per sq ft)	Previous treatment	
				<i>Percent</i>			<i>Inches</i>			
1	4/3/72	USFS, Coeur d'Alene, Idaho	Sandy loam	9.7	Englemann spruce	3-0	6-8	57	Top pruned 6/71 Root pruned 6/71 & 8/71	
2	4/5/72	USFS, Wind River Nursery, Carson, Wash.	Stabler shot loam	29.9	Douglas-fir	3-0	6	20-25	Root pruned 4/70 & 4/71	
3	4/7/72	State of Oregon, Elkton	Roseburg sandy loa	18.1	Douglar-fir	3-0	12-18	20-25	Vertical root pruned 6/71	
4	4/10/72	State of Washington, Olympia	Tumwater loam	23.6	Douglas-fir	2-0	8-10	40	None	
5	4/19/72	USFS, Bessey Nursery, Halsey, Neb.	Blow sand	6-0	Eastern red cedar	2-0	3-4	20-30	None	
6	4/20/72	State of South Dakota, Watertown	Fordville Renshaw sandy loam	15.3	Ponderosa pine	2-0	3	35	None	
7	4/25/72	State of Illinois, Topeka	Sandy clay	15.4	Jackpine	2-0	10	35	None	
8	4/26/72	State of Wisconsin, Boscobel	Sandy loam	8.0	Red pine	2-0	6	35	None	
9	4/27/72	USFS, J. W. Toumey Nursery, Watersmeet, Mich.	-----Limited testing. Paths too narrow to accomodate machine.-----							
10	4/29/72	State of Minnesota, Willow River	Sandy	19.8	Norway spruce	2-0	5	30-35	None	

built by the Center from drawings furnished by the New Zealand Forest Service. A horizontal pruner was purchased from the H. S. Marsh Co., Ltd., England, and modified to functionally

and dimensionally duplicate the New Zealand model.

**Test Procedure**

To expose the New Zealand root

pruner to a variety of operating conditions, 10 nurseries were selected to participate in the tests. Table 1 lists the nurseries and some of the conditions that prevailed. The horizontal pruning

TABLE 2.—Horizontal pruner evaluation data

Test No.	Tractor	Engine	Speed	PTO	Strokes per foot	Blade	Operating depth	Cut quality	Depth control	Bed disturbance	Seedling damage	Steering accuracy
		<i>RPM</i>	<i>MPH</i>	<i>RPM</i>		<i>Inches</i>	<i>Inches</i>					
1	John Deere 3010	1600	0.68	450	15.0	2-1/2 by 0.1875	11	Good	Good	Minor	Minor	Good
2	International 656 Hydro	1250	1.70	335	4.5	3 by 0.250	5-6	Good	Good	Minor	Minor	Good
3	International 656 Hydro	1500	.76	405	12.1	3/4 by 0.080		Good	Good	Minor	Minor	Good
4	International 656 Hydro	1100	1.10	297	5.9	3/4 by 0.080		Good	Good	Minor	Minor	Good
5	International 656 Hydro	1000	.32	270	18.9	3/4 by 0.080	6	Good	Fair	Minor	Minor	Good
6	International 656 Hydro	1500	.90	450	11.5	3/4 by 0.080	5	Good	Good	Minor	Minor	Good
7	Ford 4000	1200	.54	370	15.7	3/4 by 0.080	5	Good	Good	Minor	Minor	Good
8	Ford 5000	1200	.97	340	9.1	3/4 by 0.080		Good	Good	Minor	Minor	Good
9	-----Limited testing. Paths too narrow to accommodate machine.-----											
10	Ford 4000	1200	2.27	360	3.6	3/4 by 0.080	3-1/2	Good	Fair	Minor	Minor	Good



Figure 2.—Vertical root pruner

### Conclusions

The vertical pruning attachment of the New Zealand root pruner holds little promise for U.S. nurseries. However, the horizontal pruning attachment did an excellent job and was judged to be superior to the fixed blades currently in use at 9 of the 10 nurseries. Nurserymen who are not satisfied with the performance of the horizontal pruning attachment they are now using might find that the New Zealand reciprocating model can solve their problems. The cost of the reciprocating model will be higher and will probably be more costly to maintain.

A detailed report of the test procedures and results, and detailed construction drawings for the horizontal root pruning attachment are available from the Missoula Center. The drawings incorporate many improvements over the original model that make it easier to build, maintain, and operate. Construction cost of the machine is estimated to be \$2500, which may vary locally.

implement was tested at all 10 nurseries. However, the vertical pruning implement was tested at only four because of difficulties in mounting the unit on the tractors available. Nurserymen selected pruning depths and rated pruning quality, accuracy of pruning, and ease of operating the machine for the horizontal pruner. (See table 2). General mechanical performance, design weakness and possible improvements were noted, but no tests were run specifically for reliability or breakdowns. No data were included for the vertical attachment.

### Results and Discussion

The vertical pruning attachment was not considered effective at any of the nurseries where it was tried. The coulters did not penetrate deeply enough, especially in hard ground, and in some tests it did not prune to the desired depth. Much of the weight of the tractor was carried by the coulters rather than the front wheels, making steering difficult. The coulters in front of the machine

made it difficult for the operator to see the rows and maintain proper alignment.

Nurserymen were generally pleased with the performance of the horizontal pruning attachment. Pruning quality was good with three different blades that were tried. Several nurserymen like the capability to vary the amount of soil disturbed by using different blades. Blades can be changed to match soil conditions, seedling species and size, and to control the degree of root disturbance.

Nurserymen also agreed that the pruning action of the reciprocating blade was superior to that of a fixed blade under difficult conditions. The horizontal pruning attachment was easy to steer unless paths were very narrow. Some nurserymen felt, however, that the trenches opened by the two coulters to accommodate the rocker arms would cause excessive aeration of the outside rows of seedlings even though the mouldboards covered the trench.

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