Effects of Transmission Towers On Orchards And Vineyards

By William S. Scott

Both electric power transmission corridors and productive farmlands are vital contributors to Ontario's economy. It is also true that transmission towers can pose difficulties for the farm operator in terms of the loss of productive area and interference with the movement of machinery. To determine the impact of transmission facilities on orchard and vineyard operations, Ontario Hydro funded a research study conducted by the Horticultural Research Institute of Ontario.

Economic losses to peaches and grapes, two of the major crops in the Niagara Peninsula area were determined by using a simulated tower measuring 28 feet square at the base. While peaches were the only tree fruit studied, findings for that crop should relate fairly closely to other tree fruits. The simulated tower permitted accurate estimates of crop losses and made the simulation runs much more realistic for the tractor operator. In addition, a field survey of existing towers was conducted in the fruit-growing area.

The pre-fabricated tower base was situated in different locations (see Figures 1 and 2) and used to determine lost machine and operator time, lost crops, and non-workable area requiring herbicide. These losses were priced using industry averages and totalled to compute the annual expense of the tower to a grower (in 1977 dollars). A series of typical field operations were performed around and within the tower base. Measurements were also recorded to indicate required clearances between vehicles and the tower. Only annual losses were considered in the study, and therefore one-time costs such as the cost of constructing additional bracing for the short trellises required in some vineyard locations were not included in the calculations.

Some farm operators may be able to drive through the tower base area because of their equipment size, and some fruit trees can be grown within the tower base. This is particularly so in the case of peaches, and therefore, the case of driving through (and growing trees within) the base was examined in addition to the case of not driving through (and not growing trees within) the base. At each location (see Figure 1), measurements were made of how much of each tree would have to be removed for either case, to accommodate a tower. For example, at Location 9 (see Figure 1), either 2.125 or 9 trees would have to be removed depending on whether equipment could pass through the base or not.

In the case of grapes, however, only the situation where there was no driving through, and no cropping within the tower base area was investigated. This was because nearly all of the grapes grown in Niagara are harvested by machines which can neither pass through nor harvest under the tower.

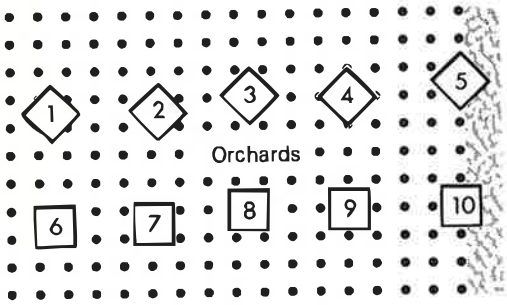


Figure 1—The tower locations studied in a peach orchard included orientations where the center of the tower was aligned with the centerline of trees in one or both directions, or aligned with the middle of tree centerlines.

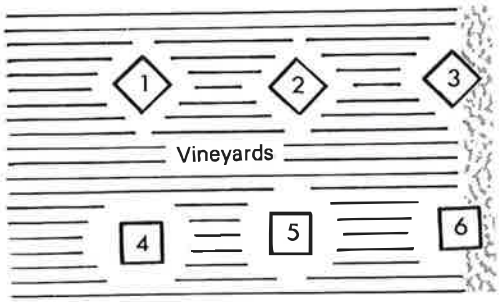
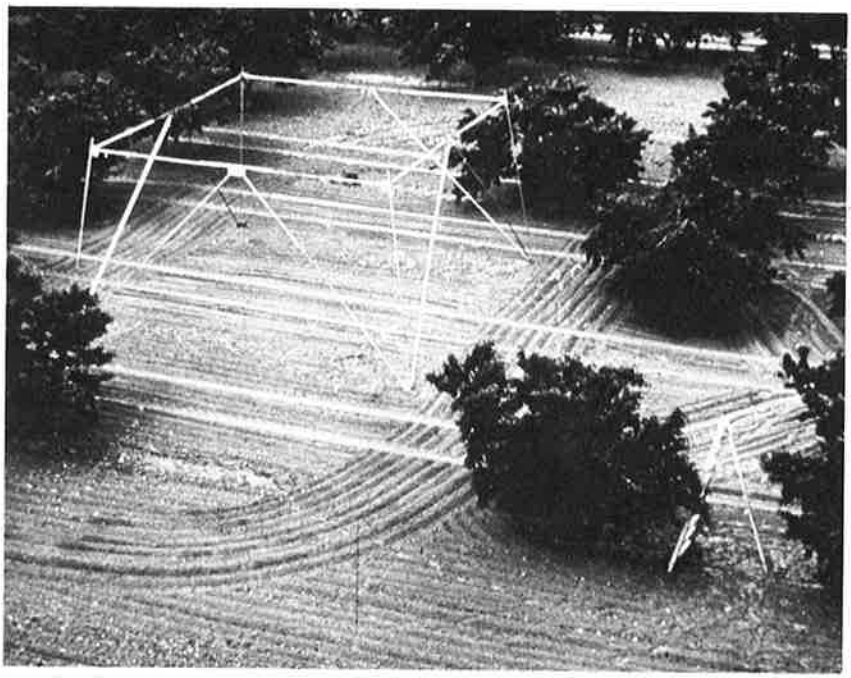


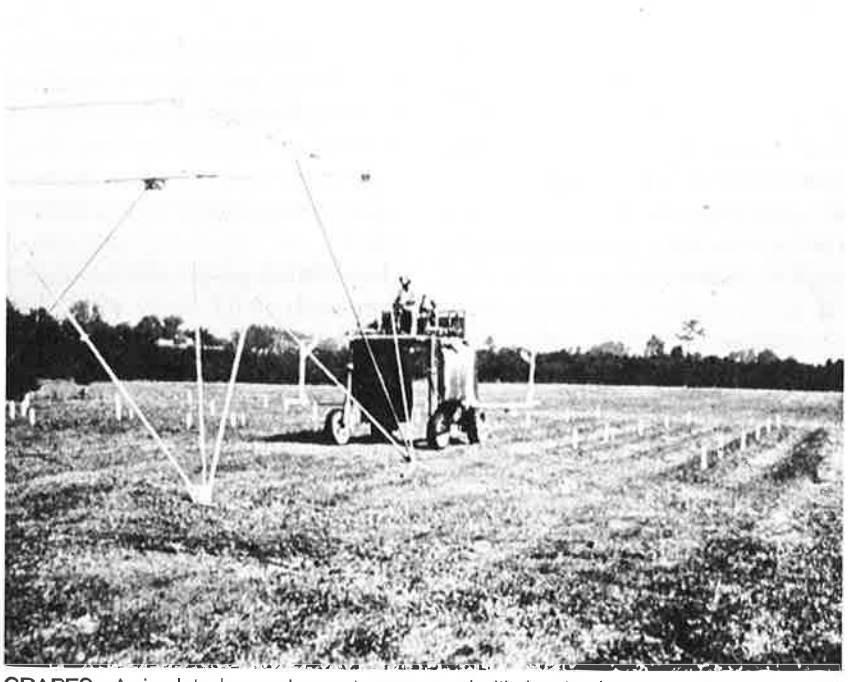
Figure 2—Tower locations studied by simulation in a vineyard.

TIMED—All operations were timed with the simulated tower base in a variety of locations.

Tests were conducted with common orchard vehicles such as sprayers, and the use of modern farm technology such as fruit thinners and mechanical grape harvesters was also investigated. The ease in operating these machines around tower bases was assessed, and measurements were recorded on the time taken to perform these operations. Measurements of tree parts which had to be removed and other crop loss or damage were recorded. All of this data helped to indicate the overall economic impact of towers on these types of crops.



PEACHES—A simulated tower base was used to study the effects on peach orchard operations.



GRAPES—A simulated grape harvester was used with the simulated base to evaluate the effects on vineyard operations.

Time Loss

All the common field operations for each particular crop were timed by comparing the time required to cover an area of the field with or without the simulated tower present. The lost time for each operation was related to a standard rate of work for that operation and then converted to dollar values. After these values had been calculated for each operation in the production of the specified crop, they were combined to arrive at an overall value for time loss (see Tables 1 to 3).

The time loss varied greatly for each different operation and tower location, depending on the number of interrupted passes of equipment. Time loss also depended on whether the particular equipment could pass beneath the tower or not and therefore depended on equipment size.

Weed Control

The area requiring an annual herbicide application to control weeds was measured as the area not cultivated after all passes had been made by the tower. Herbicide costs were calculated on the basis of using Sinbar (at $13/lb., 1977 dollars) at a rate of 1 lb/acre. Application costs were based on an estimated $10/hour for machinery and labour. Tables 1 to 3 present the weed control costs associated with the various tower locations.

Crop Loss

In orchard production (peaches as the test crop) most machinery could pass within the tower base, and the height of the trees (normally not greater than 15 feet high) did not restrict them from being grown within the tower base area. The tower situations were examined with and without driving through the base, and the proportion of each tree which would have to be removed to prevent undue interference with machinery movement was estimated and totalled for all trees affected by each tower location.

For the grape studies, the prefabricated tower base was set up in a simulated vineyard. Since nearly all Niagara grapes are harvested by machines which can neither pass through nor harvest under the tower,

Table 1

Costs for a Transmission Tower (28 ft. square)
Located in a Peach Orchard
(Based on Driving Through Tower Base)

	Location*									
	1	2	3	4	5	6	7	8	9	10
Time Loss	$ 3.70	3.52	1.48	2.62	2.70	1.32	1.48	1.96	1.38	1.70
Weed Control	$ 1.72	1.66	1.24	1.34	2.03	1.45	1.39	1.82	1.77	1.61
Crop Loss	$ 70.35	70.35	29.97	56.28	56.28	28.14	31.65	38.69	29.90	31.66
TOTAL	$ 75.77	75.53	32.69	60.24	61.01	30.91	34.52	42.47	33.05	34.97

*See Figure 1 for location.

Table 2

Costs for a Transmission Tower (28 ft. square)
Located in a Peach Orchard
(Based on NOT Driving Through Tower Base

	Location*									
	1	2	3	4	5	6	7	8	9	10
Time Loss	$ 5.70	5.48	4.62	4.60	3.98	4.26	4.48	4.56	6.46	5.60
Weed Control	$ 3.33	3.33	3.39	3.39	3.86	3.56	3.84	3.77	4.34	3.73
Crop Loss	$ 98.49	102.01	84.42	84.42	56.28	84.42	84.42	84.42	126.63	84.42
TOTAL	$107.52	110.91	92.43	92.41	64.12	92.24	92.74	92.75	137.43	93.75

*See Figure 1 for location.

only the case of not driving through the tower base was considered. Growers who still harvest by hand would be able to continue one row through the tower in some cases.

Provincial averages for yield and price were used to determine the annual value of trees or vines that had to be removed. The annual crop losses, as a result of a tower's presence, make up a very high portion of the total costs as shown in Tables 1 to 3. Where trees are grown inside the base area, there is a lower associated cost than the same orientations with no trees. Similarly, in hand-harvested vineyards, losses would be significantly lower since one or two rows could be continued through the tower base.

Tower Location

The results illustrate a wide range in the economic effect of a tower depending on its location and orientation, and whether or not equipment can pass through the base area. The "square" orientation was preferable in the case of peaches; however, the "diamond" orientation showed slight advantages in the case of vineyards.

In conclusion, the greatest economic effect of the towers results from the creation of a nonproductive area and its associated lost crop. This represents approximately 80 to 90 percent of the total costs. The information provided is valuable in the planning process to compare the effects on various agricultural operations in overall right-of-way selection and to assist in assessing impacts on the individual farm operation. This information must be utilized in conjunction with other environmental information on areas such as wetlands and sensitive wildlife habitat.

It should be noted that quantification of impacts to agriculture is only one step in breaching the gap between utility planners, who have traditionally not looked beyond their own rights-of-way, and farmers, who are reluctant to accept the needs of the society at large when those needs impinge on the "home farm." Superior planning, in all its aspects, along with more open dialogue are both required modifications to our approach in utility development.

Table 3

Costs for a Transmission Tower (28 ft. square)
Located in a Vineyard
(Based on NOT Driving Through Tower Base)

	Location*					
	1	2	3	4	5	6
Time Loss	$ 16.38	14.61	8.96	17.78	16.04	8.83
Weed Control	$ 3.35	3.38	3.30	3.61	3.57	3.61
Crop Loss	$ 91.94	83.00	35.76	98.33	94.50	40.87
TOTAL	$111.67	100.99	48.02	119.72	114.11	53.31

*See Figure 2 for location.