

# ACID INJECTION SYSTEM FOR NURSERY IRRIGATION WATER

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In southern Ontario the tree nurseries of the Ontario Department of Lands and Forests are located on soils that are slightly acid to alkaline in reaction. Because the main production of these nurseries is conifer stock, such as white, red, jack, and Scotch pine and white and black spruce, a number of problems related to the generally alkaline reaction of the soils have arisen in growing these species.

The techniques for acidification of nursery soil such as the addition of sulphuric acid or flowers of sulphur are well known,<sup>3</sup> and sulphur and acid peat are soil amendments which have been used in Ontario for this purpose.

In 1958, a study of the quality of irrigation waters was undertaken and this showed that to a large degree the pH of many of the soils in these nurseries was being kept high, if not actually increased, by the addition of alkaline irrigation water. Irrigation waters were sampled at frequent intervals during the growing season and buffer curves for each sample were prepared. From such curves it was possible to calculate the amount of acid which would be necessary to reduce the pH of the water to a desired value.

A sulphuric acid injection system was installed at the Orono Nursery of the Ontario Department of Lands and Forests and operated successfully during the 1960 growing season (fig. 1). Figures 2 and 3 are photographs of the installation in the pump house.

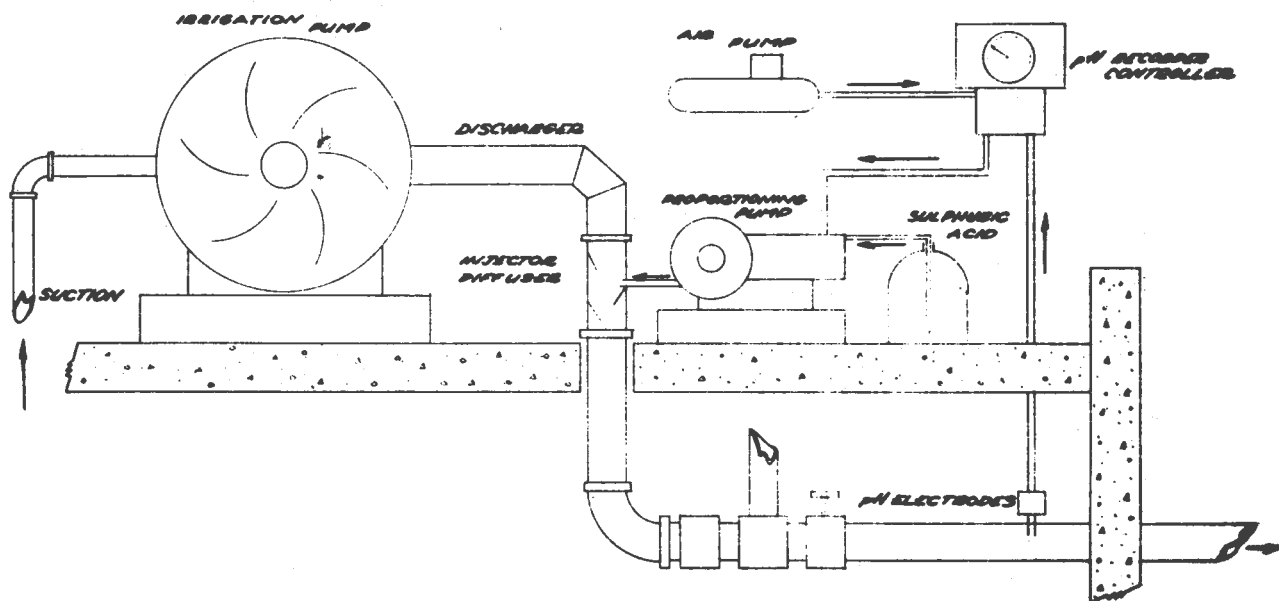


Figure 1.--Layout of acid injection system for acidifying alkaline forest nursery irrigation water.

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<sup>3</sup> Stoeckeler, J. H., and Jones, G. W. Forest Nursery Practice in the Lake States. U.S. Dept. Agr., Agr. Handb. 110, 124 pp., illus. 1957.

The irrigation pump has a capacity of 480 gallons per minute and is driven by a 75-hp. electric motor (fig. 2). Control of the injection is done by measuring the pH of the irrigation water downline from the point of injection (fig. 3). Injection is, of course, on the discharge side of the pump so that the impeller blades will not be damaged. The pH is recorded on a continuous recording disk and activates a control system by means of a pneumatic signal. This signal controls the stroke length of an acid proportioning pump. Mainline injection is done in a special pipe fitted with baffles to ensure thorough diffusion of acid prior to contact with the electrodes of the pH control unit.

The desired pH value was 6.0 and this meant a reduction from approximately pH 8.0 of the untreated water. At these values, the consumption of commercial grade concentrated sulphuric acid was approximately 3 gallons (U.S.) per hour.

Analyses of the irrigation water at the pump intake and at the irrigation line in the field were made (table 1). Although the concentrations of cations (calcium, magnesium, potassium, and sodium) have not been changed by treatments those of certain of the anions have been altered. Thus, the concentration of the bicarbonate ion has been reduced and that of the sulphate ion increased, as might be expected. Experiments to determine the long-term effect of the acidified water on the soil and the production of seedling crops are in progress.

TABLE 1.--Analyses of irrigation water before and after acid injection, sampled August 12, 1960

Cations and anions	Concentration in milliequivalents per liter--	
	before injection, pH 8.08	after injection, pH 6.09
<b>Cations:</b>		
Ca.....	3.16	3.17
Mg.....	1.22	1.27
K.....	0.06	0.06
Na.....	0.15	0.15
<b>Anions:</b>		
CO <sub>3</sub> .....	--	--
HCO <sub>3</sub> .....	3.72	0.88
SO <sub>4</sub> .....	0.38	3.09
Cl.....	0.30	0.31

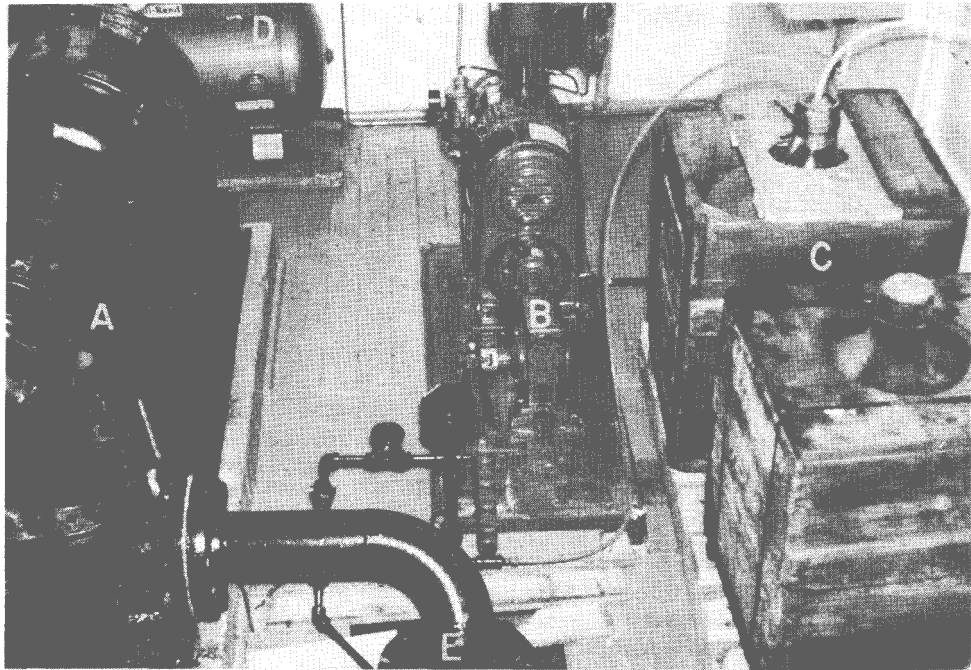


Figure 2.--Part of the acid injection system in pumphouse at Orono Nursery. A, Main water pump and motor. B, Acid injection pump. C, Carboy of sulphuric acid. D, Compressor unit for pneumatic control. E, Pipe fitted with baffles for mainline acid injection.

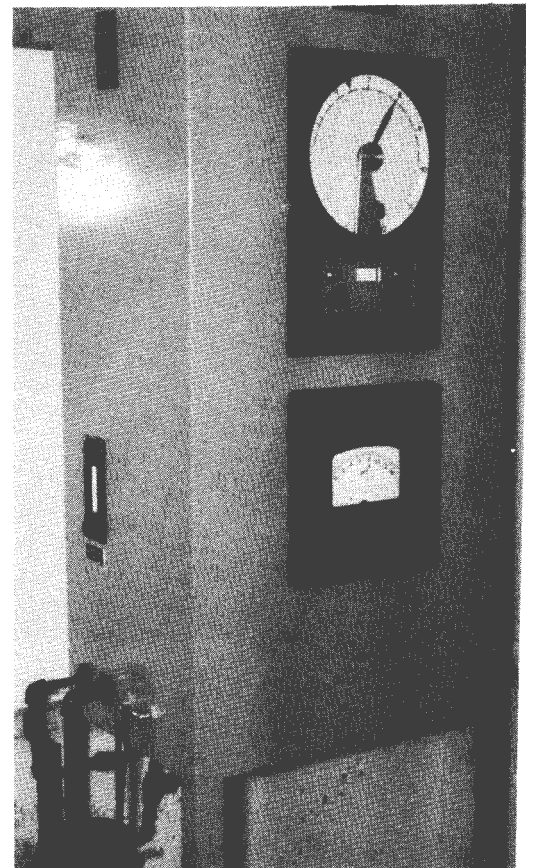


Figure 3.--Irrigation water pH control unit in pumphouse at Orono Nursery.