THE RELATIONSHIP BETWEEN RATE OF FLOW OF A SINGLE OPEN NOZZLE AND HEIGHT OF THE COLUMN OF WATER IT PRODUCES

by

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of a Single Open Nozzle and Height of the
Column of Water it Produces

<u>Object:</u> To determine different rates of flow through an open nozzle of 3/16" throat oriface under different heights of liquid. (ie) [different pressures].

Materials and Methods

A Spraying System nozzle of 3/16" throat size was mounted in a glass cylinder, 5 inches in diameter and 40 inches long. The cylinder was mounted to a common laboratory stand by two chain clamps which held it in an upright position.

The nozzle was held, pointing upward, by a test tube clamp and positioned so the nozzle oriface was flush with the bottom of the glass cylinder. It was connected by a short piece of 3/8" (10) silicone tubing to the water tap, which was used to regulate the height of the column of liquid inside the glass cylinder. (See Fig. I).

The glass cylinder, containing the nozzle, was mounted over the centre of the sink so that all sprayed liquid could be retained for measurement.

Before each run, the height of water spouting from the nozzle was adjusted to the predetermined height and allowed to run for two minutes to allow the column to become stable. After the column of water became stable, the plug was inserted in the sink and a stop watch was started simultaneously. After approximately five minutes the water was shut off and the time recorded.

The water collected in the sink was then syphoned into a 3500 ml and a 1000 ml graduated cylinder and the volumes recorded. (Table I).

Each was carried out 3 times and then an average volume and flow rate worked out.

The time of each test above 25 inches was lowered because too much splashing occurred in sink as it filled above the 3/4 full level. Water temperature throughout the experiment remained constant at 40°, F.

Conclusions

Below 5 inches, the pressure behind the water is not great enough to force the water through the nozzle throat and directly into the air, thus it fills the neck of the nozzle before running into the sink. Since this does not give the true height of liquid, the data obtained at the ½ inch reading is not accurate and should be ignored.

It can now be seen from the data presented in Table I and Fig. 2, that there is direct relationship between the height of a column of liquid forced up by a nozzle and the rate of flow of that particular nozzle.

Relating this data to spray aircraft used for forest insect control, an accurate rate of flow can now be determined by measuring the height of the column created by each nozzle and relating it back to graph. This will also standardize the Rate of Flow for all aircraft used, rather than using spray pressure as the criteria for determining how much volume has been put out.

To insure an efficient use of the entire spray system, (when all other factors such as; air speed, boom position and nozzle angle are correct) each column height from each nozzle should be the same, thus insuring the same droplet spectrum.

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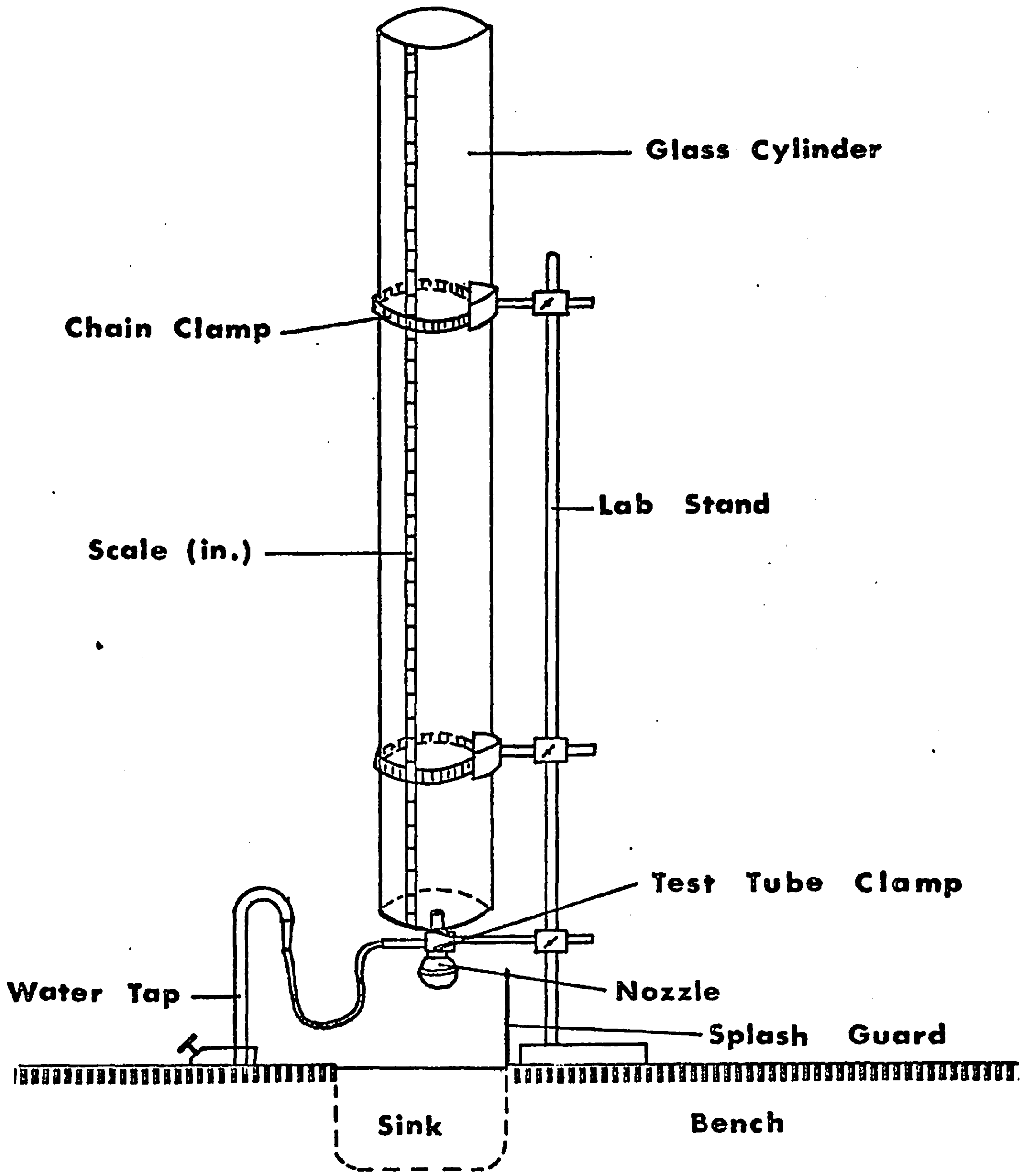

Fig. 1 DIAGRAM OF EXPERIMENTAL APPARATUS

Table I

Summary Data - Calibration of 3/16" Open Nozzle

Test	Run No.	Height of Column (in)	Time (min)	Volume (liters)	Rate (liters/min)	Average (liters/min)	Rate Gal/min.
A	1	0.25	1.0	0.81	0.810	0.824	0.218
	2		3.0	2.42	0.807		
	3		5.0	4.275	0.855		
B	1	0.5	5.0	8.180	1.636	1.641	0.434
	2		5.0	8.245	1.649		
	3		5.0	8.185	1.637		
C	1	5	5.0	10.54	2.108	2.046	0.541
	2		5.0	9.81	1.962		
	3		5.0	10.34	2.068		
D	1	10	5.0	13.060	2.612	2.660	0.703
	2		5.0	13.480	2.696		
	3		5.0	13.360	2.672		
E	1	15	5.0	15.710	3.142	3.153	0.833
	2		5.0	15.885	3.177		
	3		5.0	15.705	3.141		
F	1	20	5.0	18.140	3.628	3.610	0.954
	2		5.0	18.230	3.646		
	3		5.0	17.785	3.557		
G	1	25	5.0	20.05	4.010	4.083	1.079
	2		5.0	20.38	4.076		
	3		5.0	20.81	4.162		
H	1	30	4.0	17.670	4.418	4.376	1.156
	2		4.0	17.250	4.313		
	3		4.0	17.590	4.398		
I	1	35	4.0	19.390	4.848	4.830	1.276
	2		4.0	19.570	4.893		
	3		4.0	19.000	4.750		
J	1	40	3.0	15.330	5.110	5.105	1.349
	2		3.0	15.460	5.153		
	3		3.0	15.150	5.053		

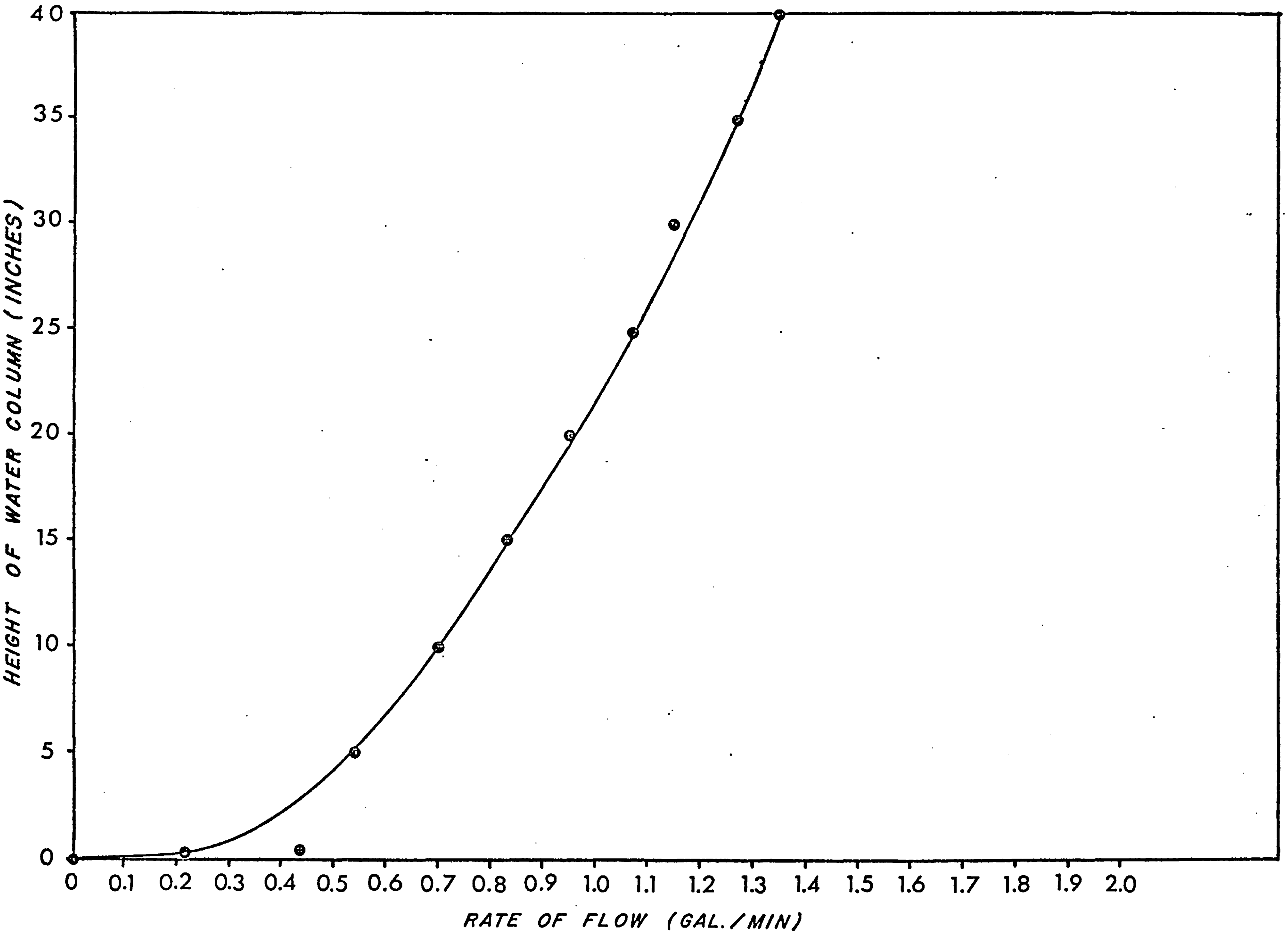

Fig. 2 RELATIONSHIP BETWEEN COLUMN HEIGHT AND RATE OF FLOW