

SPRINKLER NOZZLE DISCHARGE MEASUREMENTS

The measurement of sprinkler nozzle discharges plays an important role in not only the design but also the management of sprinkler irrigation systems.

There are two basic methods for the measurement of sprinkler nozzle discharges:

1. Volumetric Method
2. Pitot Tube Method

The following is a brief explanation of both measurement methods.

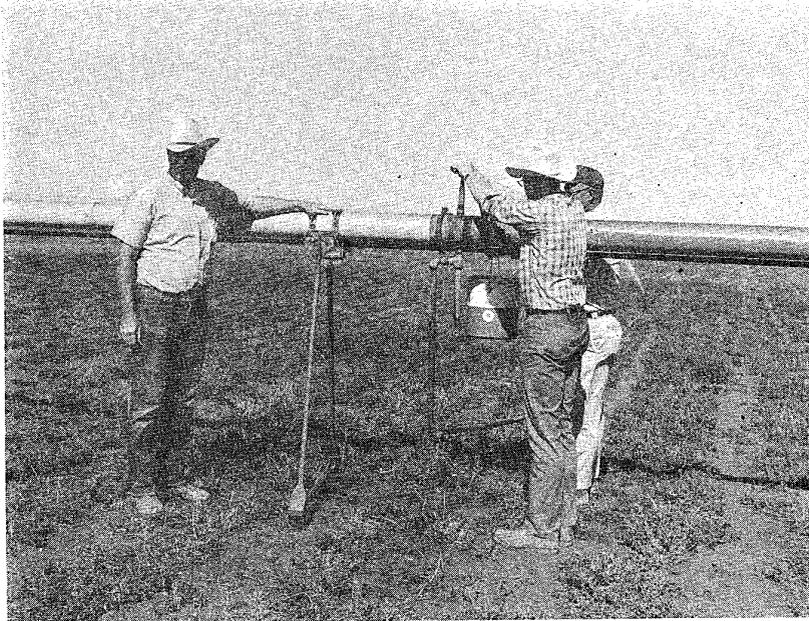
Volumetric Method

The volumetric method is the most accurate of both methods because it measures the exact discharge of the nozzle.

The equipment needed to perform the volumetric measurement consists of:

1. 5-gallon container
2. Small length of garden hose
3. Watch with second hand

While the sprinkler is operating under pressure, the length of garden hose is slipped over the nozzle, allowing the water to flow through the hose to the ground. The 5-gallon container is then placed under the discharging hose and the time necessary to fill the container is recorded. From this measurement the sprinkler discharge in GPM is calculated.



EXAMPLE

Time to fill 5-gallon container - 90 seconds

$$\text{Sprinkler discharge} = \frac{5 \text{ gal.}}{1.5 \text{ min.}} = 3.3 \text{ GPM}$$

If the sprinkler being measured has a double nozzle, the discharge from each nozzle is added together to get total nozzle discharge.

Pitot Tube Measurement

The equipment necessary for this type of nozzle discharge measurement consists of:

1. Pitot tube and pressure gage
2. Sprinkler discharge tables

This method is the quickest and simplest method of measuring nozzle pressure and discharge. The main disadvantage of this method is that sand or other debris may enlarge nozzle, making it a greater size than that stamped on the nozzle. Therefore, care must be taken to assure that the existing nozzle size is the same as that stamped on the nozzle.



EXAMPLE

Sprinkler Nozzle Size - 3/16

Nozzle Pressure - 55 PSI

Nozzle Discharge - (From sprinkler tables) - 7.5 GPM

Average Discharge of Sprinkler Lateral

The average nozzle discharge of a sprinkler lateral (except circular systems) is calculated by the following formula:

Avg. Discharge = 1st Nozzle Discharge less 3/4 (Difference between 1st and last nozzle)

The above formula is correct only if all nozzles on the lateral are the same size.

EXAMPLE

1st Nozzle Discharge = 6.8 GPM

Last Nozzle Discharge = 5.7 GPM

Difference = 1.1 GPM

Avg. Discharge = $6.8 - 3/4(1.1) = 6$ GPM

The total output of the lateral can be found by multiplying the average nozzle discharge by the total number of nozzles on the lateral.

Application Rate of the Lateral

The gross application rate of the sprinkler lateral (except circular systems) can be calculated from the following formula:

$$\text{Application Rate (" / Hr)} = \frac{\text{Average Nozzle GPM} \times 96.3}{\text{Lateral Spacing} \times \text{Sprinkler Spacing}}$$

EXAMPLE

Average Nozzle GPM - 6 GPM

Lateral Spacing - 50'

Sprinkler Spacing - 30'

$$\text{Gross Application Rate} = \frac{6 \times 96.3}{30 \times 50} = .39 \text{ " / Hr}$$

If the lateral and sprinkler spacing, along with nozzle discharge pressures, are within recommended ranges, the net application rate of the sprinkler lateral can be approximated by multiplying the gross application rate by .65.

EXAMPLE

Gross " / Hr. = .39

Net " / Hr. = $.39 \times .65 = .25$ " / Hr.

Circular Sprinkler Systems

The measurement of application rate and total discharge from a circular sprinkler system is outlined in Engineering Tech Note NM-1.

SPRINKLER DISCHARGES FOR TYPICAL DOUBLE AND SINGLE NOZZLE SPRINKLERS

NOZZLE PRESSURE PSI	DOUBLE NOZZLE SIZES													
	9/64 x 3/32		5/32 x 3/32		11/64 x 3/32		3/16 x 3/32		3/16 x 1/8		13/64 x 1/8		7/32 x 1/8	
	DIAMETER	GPM	DIAMETER	GPM	DIAMETER	GPM	DIAMETER	GPM	DIAMETER	GPM	DIAMETER	GPM	DIAMETER	GPM
30	81	4.1	85	5.3	88	6.1	91	6.9	91	8.1	94	9.2	98	10.3
35	82	4.8	85	5.7	90	6.6	94	7.5	94	8.8	97	9.9	100	11.1
40	83	5.2	88	6.1	92	7.0	96	8.1	96	9.5	99	10.7	102	11.9
45	84	5.5	89	6.5	93	7.5	98	8.6	98	10.1	101	11.3	104	12.7
50	85	5.8	90	6.8	95	7.8	100	9.0	100	10.6	103	11.9	106	13.3
55	86	6.1	91	7.2	96	8.3	101	9.5	101	11.1	104	12.5	107	13.9
60	87	6.3	92	7.5	97	8.6	102	9.9	102	11.6	105	13.0	108	14.4
PSI	SINGLE NOZZLE SIZES													
	9/64		5/32		11/64		3/16		13/64		7/32			
30	81	3.2	85	3.9	88	4.6	91	5.5	94	6.5	96	7.6		
35	82	3.4	87	4.2	90	5.0	94	6.0	97	7.1	100	8.3		
40	83	3.6	88	4.5	92	5.4	96	6.4	99	7.6	102	8.8		
45	84	3.8	89	4.7	93	5.7	98	6.8	101	8.1	104	9.4		
50	85	4.0	90	5.0	95	6.0	100	7.2	103	8.5	106	9.9		
55	86	4.2	91	5.2	96	6.3	101	7.5	104	8.9	107	10.3		
60	87	4.4	92	5.4	97	6.6	102	7.8	105	9.2	108	10.6		

NOZZLE PRESSURES ABOVE THE DASHED LINE ARE NOT RECOMMENDED AREAS