UNIVERSITY OF ARKANSAS
DIVISION OF AGRICULTURE
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Agriculture and Natural Resources

Calibrating Stationary Big Gun Sprinklers for Manure Applications

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Importance of Calibration

You can avoid the potential adverse effect on ground and surface water caused by over fertilization by applying only the amount of waste and wastewater necessary to maintain soil fertility for crop production.

The calibration of liquid manure spreading equipment is important because it lets you know the amount of waste and wastewater you are applying to an area.

The calibration rate and the nutrient concentration level of the liquid manure lets you know the amount of plant nutrients you are applying. Then, you can adjust your fertilization rate to avoid over fertilization.

Calibration

The wastewater application rate from a stationary big gun sprinkler depends on the flow rate, coverage diameter, the amount of time it operates at a location, and the sprinkler location pattern. To attain acceptable application uniformity with multiple sprinkler setups the sprinkler spacing should be 70 to 85 percent of the sprinkler's coverage diameter (see Figure 1). The necessary steps to calibrate stationary big gun sprinklers are given in the example below.

1) Determine flow rate in gallons per minute (GPM) from available manufacturer's literature or **Table 1**.

Example: From **Table 1**: 0.75″ nozzle at 90 PSI has a flow rate of 155 GPM

Your Numbers: ___″ nozzle at ____ PSI has a flow rate of ____ GPM

2) Determine the coverage diameter (DIA) in feet from available manufacturer's literature or **Table 1**.

Example: From **Table 1:** 0.75″ nozzle at 90 PSI has a 306 ft coverage diameter (DIA)

Your Numbers: ___″ nozzle at ____ PSI has a ___ ft coverage diameter (DIA)

3) Calculate the needed sprinkler spacing (SS) as 70 to 85% of the coverage diameter (DIA) from **Step 2**. Refer to **Figure 1** for a diagram of a stationary gun setup.

Example: 306 ft x 77% ÷ 100 = 236 ft sprinkler spacing (SS);
use 230 to 240 ft

Your Numbers: ____ ft x ___% ÷ 100 = _____ ft sprinkler spacing (SS);
use _____ ft

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4) To calculate the average application rate (in/hr), multiply 96 by the GPM from **Step 1** then divide by the **Step 3** sprinkler spacing (SS) twice.

Example: 96 x 155 GPM ÷ 236 ft SS ÷ 236 ft SS = 0.27 in/hr

Your Numbers: 96 x ____ GPM ÷ _____ SS ÷ _____ SS = ____ in/hr

5) To determine the inches of wastewater to apply for a given N rate, divide the desired number of pounds of N per acre by the number of pounds of N in a 1000 gallons of wastewater[1]. Then divide the result by 27 to get the inches of wastewater.

Example: 150 lb N/ac ÷ 5 lb N/1000 gal ÷ 27 = 1.1 in

Your Numbers: ____ lb N/ac ÷ ____ lb N/1000 gal ÷ 27 = _____ in

6) To determine the number of hours to operate the sprinkler at each location divide the inches of wastewater from **Step 5** by the application rate from **Step 4**.

Example: 1.1 in ÷ 0.27 in/hr = 4 hr

Your Numbers: _____ in ÷ _____ in/hr = _____ hr

OR

5) To determine the inches of wastewater that were applied multiply the application rate from **Step 4** by the number of hours the sprinkler operated at a location.

Example: 0.27 in/hr x 4 hrs = 1.1 in

Your Numbers: _____ in/hr x _____ hrs = _____ in

6) The N applied per acre (lb N/ac) is calculated by multiplying the inches of wastewater applied from **Step 5** by the pounds of N in a 1000 gallons of wastewater and then multiply this result by 27.

Example: 1.1 in x 5 lb N/1000 gal x 27 = 150 lb N/ac

Your Numbers: _____ in x _____ lb N/1000 gal x 27 = _____ lb N/ac

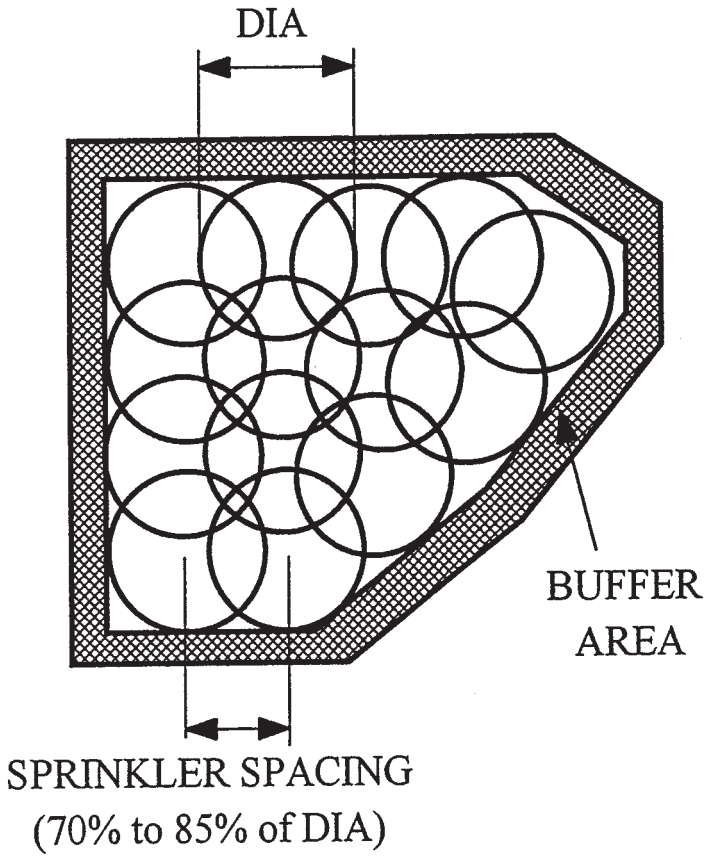
[1]Refer to the University of Arkansas Extension publications Liquid Animal Waste Sampling (FSA 3006) and Understanding Your Animal Waste Nutrient Analysis (FSA 3008) for information on having your liquid manure analyzed and interpreting the analysis.

Table 1. General Flow Rates and Coverage Diameters for Big Gun Sprinklers. Nozzle size is in inches. Flow rate is in gallons/minute (GPM). Operating pressure is in pounds/square inch (PSI). Coverage diameter (DIA) is in feet (ft).

	Nozzle 0.5˝		Nozzle 0.75˝		Nozzle 1˝		Nozzle 1.25˝		Nozzle 1.5˝		Nozzle 1.75˝		Nozzle 2˝	
PSI	**GPM**	**DIA**	**GPM**	**DIA**	**GPM**	**DIA**	**GPM**	**DIA**	**GPM**	**DIA**	**GPM**	**DIA**	**GPM**	**DIA**
50	50	205	115	256	204	300	325	353	---	---	---	---	---	---
60	55	215	126	270	224	316	358	373	515	430	695	470	912	512
70	60	225	136	283	243	338	385	388	555	450	755	495	980	528
80	64	235	146	295	258	354	413	403	590	470	805	515	1047	548
90	68	245	155	306	274	362	440	418	625	485	855	535	1105	568
100	72	255	163	316	289	372	463	430	660	500	900	550	1167	592
110	76	265	171	324	304	380	485	440	695	515	945	565	1220	607
120	---	---	---	---	---	---	---	---	725	530	985	580	1277	622
130	---	---	---	---	---	---	---	---	755	540	1025	590	1333	640

NOTE: If your exact numbers are not in the table, then estimate your value based on the numbers nearest yours.

Figure 1. Typical Stationary Gun Layout



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