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DRIP OR SOLID-SET CHEMIGATION INJECTION RATE WORKSHEET FOR VOLUME-BASED APPLICATIONS

Chemigation Calculation Worksheet Series

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Drip or Solid-Set Chemigation Injection Rate Worksheet for Volume-Based Applications

This worksheet helps growers, consultants, or fieldmen to calculate the **chemical** injection rate for **static irrigation systems** that don't move during irrigation, such as drip, solid set, hand lines, or wheel lines, when the application rate is **specified in fluid ounces, pints, quarts, or gallons per acre.**

Chemigation pump set up to inject fertilizers and agricultural chemicals for distribution to field crops with the irrigation water.

Required Information:

1. Application area width in feet (width of the total area that is irrigated during the set).
2. Application area length in feet (length of the total area that is irrigated during the set).
3. Product application rate in ounces, pints, quarts, or gallons per acre (refer to pesticide label).

Example: Applying a pesticide at 2 pints per acre into a drip irrigation system. The drip tubes/tape are spaced in rows that are 8 feet apart with an average run of 820 feet. The application block or set contains 32 drip lines per irrigation set. The grower typically irrigates in 8-hour sets, and the pesticide label recommends that the product should be applied during the middle third of the irrigation set.

AREA: Determine the size of the field in acres.		
	Example	**Your System**
A. Size of Application Block • Application block width, in feet. • Application length, in feet.	8-foot row spacing × 32 rows = **256 ft**	
	820 ft	
B. Area of Treatment in Square Feet If not rectangular, calculate accordingly. Width, in feet × Length, in feet.	256 ft × 820 ft = **209,920 ft²**	
C. Acreage in Application Block Field Area. Convert to acres. Acres = Square feet ÷ 43,560 ft²/acre. (C = B ÷ 43560)	209,920 ft² ÷ 43,560 = **4.82 acre**	

VOLUME TO APPLY: Determine the total volume of chemical to apply in gallons.		
	Example	**Your System**
D. Chemical Application Rate Volume of chemical to be applied per acre from the label. (May be in different units.)	**2 pint/acre**	
E. Total Product Volume Volume to be applied. Volume per acre × Total acres. (E = D x C)	2 pint/acre × 4.82 acre = **9.6 pint**	
F. Unit Conversion Total volume (E) converted to gallons. 1 gallon = 4 quarts = 8 pints = 128 fluid ounces	9.64 pint ÷ 8 pint/gal = **1.21 gal**	

APPLICATION TIME: Determine the application duration in hours.		
The injection timeframe during the irrigation set and injection duration are typically specified on the product label or indicated by the crop advisor or fieldman in order to spatially set the chemical within the crop canopy or in the soil profile.		
	Example	**Your System**
G. Application Duration Application duration in hours. For a pesticide, refer to label instructions.	Label states to inject during the middle third of run time which is 8 hr. 8 hr × 1/3 = **2.67 hr**	

INJECTION RATE: Calculate the injection rate in gallons per hour.		
	Example	**Your System**
I. Injection Rate in Gallons per Hour Total volume ÷ Application time. (H = F ÷ G)	1.21 gal ÷ 2.67 hr = **0.45 gal/hr**	

Diluting to Increase the Injection Rate.

Unless specifically made for low flow rates, many chemigation pumps are not capable of accurately injecting at such low injection rates. In this case, water is added to the chemical (diluted) to increase the total injected volume. This uses the simple equation **Injection Rate = Volume ÷ Time**. In this example, water is added to the calculated 1.21 gallons of chemical to increase the total volume of the solution to 50 gallons. This new volume is then used to calculate the new injection rate:

50 gal ÷ 2.67 hr = **18.7 gal/hr**

Alternatively, water can be added to match a targeted injection rate. The equation is rearranged to be **Volume = Injection Rate × Time**. For example, if the target injection rate is 20 gal/hr then the required total injected volume can be calculated as:

20 gal/hr × 2.67 hr = **53.4 gal**

Therefore, water would be added to the 1.21 gallons of chemical (or the chemical is added to the water) to increase the total volume of water plus chemical to 53.4 gallons. (53.4 – 1.21 = 52.2 gallons of water added).

Additional Information

Some helpful conversions for calibration testing:

Multiply:	By:	To Get:
gallons/hour	2.13	ounces/minute
gallons/hour	63.09	milliliters/minute
gallons/hour	0.0355	ounces/second
gallons/hour	1.05	milliliters/second

Additional Resources

Carpenter, J., and W.S. Johnson. 1997. Pesticide Chemigation through Pumped Irrigation Systems. *University of Nevada Cooperative Extension Publication* FS-97-37. University of Nevada.

DeValerio, J., D. Nistler, R. Hochmuth, and E. Simonne. 2015. Fertigation for Vegetables: A Practical Guide for Small Fields. *University of Florida IFAS Extension Publication* HS1206. University of Florida.

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Hanon, B., N. O'Connell, J. Hopmans, J. Simunek, and R. Beede. 2006. Fertigation with Microirrigation. Oakland: University of California Agriculture and Natural Resources.

Kranz, W., C. Burr, J. Hay, J. Schild, and D. Yonts. 2016. Using Chemigation Safely and Effectively: Training Manual. University of Nebraska Extension.

Liu, G., and G. McAvoy. 2015. How to Reduce Clogging Problems in Fertigation. *University of Florida IFAS Extension Publication* HS1202. University of Florida.

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Use pesticides with care. Apply them only to plants, animals, or sites as listed on the label. When mixing and applying pesticides, follow all label precautions to protect yourself and others around you. It is a violation of the law to disregard label directions. If pesticides are spilled on skin or clothing, remove clothing and wash skin thoroughly. Store pesticides in their original containers and keep them out of the reach of children, pets, and livestock.

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