

4-16-2001

## Equipment considerations: liquid fertilizer

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### Recommended Citation

Hanna, H. Mark and Sawyer, John E., "Equipment considerations: liquid fertilizer" (2001). *Integrated Crop Management News*. 1883.  
<http://lib.dr.iastate.edu/cropnews/1883>

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# Equipment considerations: liquid fertilizer

## **Abstract**

A review of application equipment considerations can help ensure that your nitrogen fertilizer is properly applied. This article focuses on liquid fertilizers and is the last in a series of three articles (other two in [April 9, 2001](#), Integrated Crop Management issue) about nitrogen fertilizer application and equipment. A primary consideration for equipment is the relatively high application volumes required. For example, a 150-lb N/acre application of 28 percent UAN solution requires an application of 50 gal/acre.

## **Keywords**

Agricultural and Biosystems Engineering, Agronomy

## **Disciplines**

Agricultural Science | Agriculture | Agronomy and Crop Sciences | Bioresource and Agricultural Engineering

# INTEGRATED CROP MANAGEMENT

## Equipment considerations: liquid fertilizer

A review of application equipment considerations can help ensure that your nitrogen fertilizer is properly applied. This article focuses on liquid fertilizers and is the last in a series of three articles (other two in [April 9, 2001](#) [1], Integrated Crop Management issue) about nitrogen fertilizer application and equipment.

A primary consideration for equipment is the relatively high application volumes required. For example, a 150-lb N/acre application of 28 percent UAN solution requires an application of 50 gal/acre. Two important considerations are 1) tending (filling) the applicator tank, and 2) the capacity of the sprayer (pumps, hoses, nozzles, and fittings) to deliver high flow rates. Greater efficiency usually requires a tending tank to deliver fertilizer from storage to the applicator.



Sprayers that have not been well maintained and updated may have problems delivering adequate flow.

A pump capacity on the applicator less than 40 gal/min and (particularly) 1/2-inch distribution hoses to boom sections are probably inadequate on larger sprayers. Older centrifugal or roller pumps may not deliver high-capacity flows without being overhauled or replaced. In addition, suspension materials may increase pump wear. Specifications for diaphragm check valves or solenoid valves to boom sections should be checked to ensure they allow desired flow rates.

Consider the example in the box below. A sprayer with a 40-ft boom and nozzles on 20-inch spacing will be used at 6 mi/hour to apply 28 percent N solution (density = 10.65 lb/gal) at a rate of 150 lb N/acre. Gallons of solution applied per acre are as follows:

$$\begin{aligned} \text{Gal 28\% UAN/acre} &= \frac{(150 \text{ lb N/acre})}{(0.28 \text{ lb N/lb 28\% UAN}) \times (10.65 \text{ lb/gal UAN})} \\ &= 50.3 \text{ gal 28\% UAN/acre} \end{aligned}$$

Pump capacity to supply the boom is calculated from the following calibration formula:

$$\text{Gal/min} = \frac{\text{gal/acre} \times \text{mi/hr} \times \text{width (inches)}}{5940} = \frac{50.3 \times 6 \times (40 \times 12)}{5940} = 24.4 \text{ gal/min}$$

where gal/acre = application rate, mi/hr = applicator speed, and width (inches) = effective sprayed width. Because of agitation and other system requirements, pump output to the boom is often doubled to determine total pump flow required (=48.8 gal/min for the example). If the boom has three sections, each supplied by 3/4-inch hose, each hose will be transporting 8 gal/min. Checking pressure-drop tables, 30 ft of 3/4-inch hose carrying solution at 8 gal/min will have a pressure drop of approximately 3 psi. Using 1/2-inch hose to feed the boom sections would create an unacceptably high loss of pressure and restrict flow.

The boom has 24 nozzles. If water were applied each nozzle would need to deliver 1.02 gal/min (=24.4 gal/min divided by 24 nozzles). Because 28 percent N solution has a specific gravity different than water, nozzles must be sized by multiplying by a conversion factor, 1.13 (equals the square root of the specific gravity of 28 percent N solution). Thus, nozzles selected to apply 28 percent N solution must deliver 1.15 gal/min (=1.02 gal/min x 1.13) of water equivalent when selecting nozzles from a catalog. Individual nozzle check-valve capacity should be checked if nozzle flow rate approaches 2 gal/min (this would occur with 40-inch nozzle spacing in this example).

Equipment should be cleaned and rinsed at the end of each day. If spraying will occur over several days and timely rinsing is difficult, using Viton seals in check valves helps to avoid rapid seal deterioration.

If you are coapplying herbicide in the same operation, check to make sure there is no antagonism between the herbicide and fertilizer. Injection, banding, or surface dribbling on a planter or row-crop cultivator with a liquid fertilizer pump and distributor are options instead of a separate sprayer application. Shallow incorporation of liquid nitrogen fertilizer can reduce potential volatilization loss.

This article originally appeared on pages 39-40 of the IC-486 (5) -- April 16, 2001 issue.

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