Chapter 10

Septage Waste Application Methods and Applicator Vehicle Calibration

10.1 Septage Waste Application Methods
There are two main methods of land applying septage waste: surface application and subsurface injection. For both surface and injection application methods, uniform application and control of daily hydraulic application rates are important and necessary.

Uniform application of septage waste: To attain uniform application rates, use of a splash plate, reverse funnel, or other mechanical device is recommended for surface appliers. For injector appliers, all injection knives and discharge tubes, etc., should be evenly spaced and the septage prescreened to prevent clogging. A one-unit injection knife is not recommended.

Daily hydraulic application rate: This is the rate of application per day on the same field. Excessive application per day may result in serious hydraulic problems and soil structure may be severely damaged. Destruction of soil structure may limit infiltration of the water contained in septage into the soil and increase the potential to run off the application site. See Chapter 14 for guidance.

In general, the less permeable the soil is, and the shallower the depth to water table, the lower the rate of daily septage application.

Make sure that the application vehicle is calibrated properly to ensure even distribution of septage. Limit the number of gallons applied to such a site to ensure infiltration of the water contained in the septage. This will prevent ponding.

A good septage management practice at any land application site should consider the following:
- Soils, characteristics, and management.
- Crops, characteristics, and harvesting restrictions.
- Isolation distances.
- Agronomic application rates.
- Erosion control.
- Odor control.
- Weather conditions before, during, and after application.
- Restricted access notice.

10.2 Surface Application
Septage waste is applied on the surface of the land (see Figure 10-1). For fallow land, that is sites with no planted crop or vegetation, the surface applied septage waste shall be incorporated into the soil within 6 hours of application (see Chapter 11, Table 11-2). Lime-stabilized septage waste may be surface applied to fallow land and mechanically incorporated within 48 hours (see Chapter 11, Table 11-2). For sites with actively growing planted crops or vegetation such as field crops, row crops, or pasture, septage waste can be surface applied over the existing crops without incorporation provided it is lime-stabilized before application (see Chapter 11, Table 11-2). Special runoff control practices may be needed around the perimeter of the field. See Chapter 8.

In order to achieve uniform application at agronomic rates, a splash plate, duckbill spray nozzle, or other mechanical device needs to be utilized on the discharge end of the applicator vehicle. The width or spread of septage on the ground should be from 6 to 9 feet or more. In Fig. 10-1, note the wide, uniform application area. Proper septage application methods result in little to no ponding.
10.3 Subsurface Injection Application
Septage waste can be applied to soil using injection knives (see Figure 10-2). The depth of injection may range from 8 inches to 12 inches.
10.4 Septage Waste Applicator Vehicle Calibration

All septage waste applicator vehicles used in land application need to be calibrated. This is to ensure that the correct amount of septage per unit area is applied uniformly at AAR. Equipment calibration is important in both surface and injection methods of septage application.

**Applicator Calibration**

![Image of a tractor with text](image)

**Q = Quantity (gallons)**

**L = Length (feet)**

**W = Width (feet)**

**Rate (gallons/acre) = \( \frac{Q \text{ (gal)}}{W \text{ (ft)} \times L \text{ (ft)}} \times \frac{43,560 \text{ (sq.ft)}}{1 \text{ acre}} \)**

Figure 10-3. Septage Waste Applicator Calibration

Septage waste applicator calibration allows the hauler to know the quantity of septage waste applied per acre. It is important to calibrate the applicator to reduce the guess work about over-application or under-application. The advantage of calibration is to allow the hauler to spread uniform amounts of septage waste at agronomic rates. Over-application of septage waste can provide more plant nutrients than the requirement of the current crop or the crop to follow. Over-application can result in the movement of the excess nutrients beyond the root zone to groundwater or surface waters which are unacceptable if environmental quality and protection is to occur. Under-application can result in poor plant growth due to insufficient supply of plant nutrients from the septage waste and other factors. Those who land apply septage waste are to keep accurate and complete records of septage waste applicator calibrations. The applicator can be calibrated annually if the consistency of septage waste is the same. The frequency of calibration may change depending on type and consistency of the waste. Several trial runs may be necessary to obtain the correct application rate for each applicator.

Several methods of liquid manure spreader calibration can be used![](1, 2, 3, 4, 5). The references give additional information about the various calibration methods. The manure calibration is adapted to septage waste calibration. For the most part, septage waste is liquid material.
10.5 Methods of Septage Waste Calibration

**Field Load Method.** This is the method where septage waste is first applied to an entire field and the total amount of the waste and the total number of acres covered are both known.

\[
\text{Application Rate (gallons/acre)} = \frac{\text{Total Amount of Septage Waste Applied (gallons)}}{\text{Total Number of Acres Receiving Septage}}
\]

This method gives an average application rate over the entire field, assuming that the septage waste was uniformly applied.

It provides the application rate after application is completed. For this reason, this is not recommended as a routine method but can be used to check the other application rate calibrations discussed.

**Distance Method:** This method involves the measurement of the width of spread, length of travel, or run to empty the contents of the applicator, and known volume of septage waste in the applicator. The length of travel can be measured using a measuring wheel, tape measure, or tire method. This method implies that the applicator is maintained at the same speed of travel. Application rate decreases with an increase in speed and vice versa. **This is the recommended method.**

\[
\text{Application Rate (gallons/acre)} = \frac{\text{Quantity of septage waste (gallons)}}{\text{Width of spread (ft)} \times \text{Length of travel (ft)} \times \text{acre}}
\]

**Example:**

\[
\begin{align*}
\text{Quantity of septage waste in applicator} &= 2,000 \text{ gallons}^* \\
\text{Width of spread} &= 10 \text{ feet} \\
\text{Length of travel} &= 1,000 \text{ feet}
\end{align*}
\]

\[
^*\text{For calibration purposes, it is best to confirm actual gallons in the applicator by weighing before and after loading with septage waste.}
\]

\[
\text{Application Rate (gal/ac)} = \frac{2,000 \text{ gallons}}{10 \text{ ft} \times 1,000 \text{ ft}} \times \frac{43,560 \text{ ft}^2}{\text{acre}}
\]

\[
= 8,700 \text{ gal/ac (rounded). Recommend rounding to at least two significant digits because it is calibration.}
\]

Those that do not want to do calculations may use the manure applicator calibration guide chart by Heemstra\(^3\). To use this method, follow the steps below:

**Step 1.** Take measurements of the width of spread and length of travel to use the chart.

**Step 2.** Type in How do you calibrate a manure spreader? by Jill Heemstra 2008\(^3\) in the Google box. This document should appear.

**Step 3.** Click to get the next page. Read the article.

**Step 4.** Click the link “Manure Applicator Calibration Guide” at the bottom of the article to get the chart.

**Step 5.** Using your data from step 1, check the application rate using the chart.

This method assumes that a 2,000 gal tank truck actually will deliver 2,000 gallons.

**Time Method:** In this method, the time of covering a defined area is used in calculating the application rate.

\[
\text{Rate of Application (gal/acre)} = \frac{\text{Quantity of septage waste in tank (gal)}}{\text{Width of spread (ft)} \times \text{Time (sec)} \times \text{Speed of travel (mph)}} \times 29,700^*
\]

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Quantity of septage waste in applicator = 2,000 gallons

Width of spread = 20 feet (Make allowance for overlap application)

Time needed to empty the applicator tank = 300 seconds

Speed of travel at a selected gear (rpm) = 2nd gear at 1,700 rpms

Rate of application (gal/ac) = \( \frac{2,000 \text{ gal} \times 29,700 \text{ ft-sec/ac}^*}{20 \text{ ft} \times 300 \text{ sec} \times 2.0} \)

\[
= \frac{2 \text{ gal} \times 29,700}{2 \times 3 \times 2 \times \text{ac}}
\]

\[
= \frac{59,400 \text{ gal}}{12 \text{ ac}}
\]

\[
= 4,950 \text{ gal/ac}
\]

* 29,700 is a conversion factor from miles per hour to feet per second plus the distance in feet needed at a given width of spread in feet to equal one acre covered with 43,560 ft\(^2\) = 1 acre.

10.6 References


