



Guidelines for Land-application of Acid Whey

Acid whey, a co-product of Greek yogurt, cottage cheese, and cream cheese manufacturing, contains nutrients that can be useful for crops (Factsheet #96). Like any material containing nutrients, land application can result in losses to the environment. Additionally, the low pH of acid whey can impact soil pH. In this factsheet, guidance is given for land application of acid whey.

Chloride limit and nutrient addition

New York State law limits annual chloride (Cl) applications to no more than 170 lbs/acre of Cl. Based on a limited set of samples (Factsheet #96), the average Cl content of 9.3 lbs Cl/1000 gallons triggers the annual limit at just over 18,000 gallons/acre. This rate also supplies approximately 130 lbs of total N, 250 lbs of P₂O₅, 300 lbs of K₂O, 180 lbs of calcium, 15 lbs of magnesium, 11 lbs of sulfur, and small amounts of boron, iron, manganese and copper. Thus, acid whey contains significant quantities of important nutrients. Whey sources should be tested to determine nutrient content to match applications with crop needs (Factsheet #33).

Impact on soil pH

Given the acidity, various rates of acid whey were applied to soil to test the impact on soil pH. At a rate of 10,000 or more gallons/acre, land-application of acid whey first results in a rapid decrease of soil pH, quickly followed by a sharp increase to levels higher than the initial soil pH and then a gradual decline over time. This pH swing, which can be as large as 2 pH units, may last up to 4 weeks and can impact establishment and growth of pH sensitive crops. For well-buffered, high pH soil types such as Honeoye, applications up to 18,000 gallons/acre will not impact the final soil pH. In acid soils, the pH eventually settles below the initial soil pH, increasing lime requirements for crop production over time. If acid whey is added to manure storage (up to a 1:1 ratio), the manure buffers the whey and the resulting mixture will have little or no effect on soil pH.

Odor

Land application of fresh acid whey does not present an odor issue, but acid whey odor may

increase significantly with time in storage and when co-stored with manure. If there are concerns about odor, incorporate or inject the acid whey or acid whey-manure mixtures.

Infiltration rates

Similar to the solids in manure, solids in acid whey can plug soil pores and influence infiltration rate. When acid whey and manure are mixed, the mixture behaves like manure. Field testing of infiltration rates of acid whey itself compared to liquid manure or water to the surface of four different tilled soils has shown:

- Whey infiltrates slower than water but faster than manure with a comparable solids content (Figures 1 and 2).
- Solid content of the whey impacts infiltration; the lower the solids content, the faster the infiltration rate.
- The first 10,000 gallon/acre acid whey application infiltrates more quickly than the second 10,000 gallons/acre application, reflecting differences in initial soil moisture content (Figure 3).

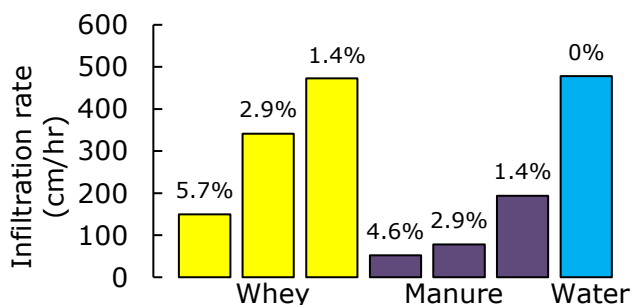


Figure 1: Infiltration rate of acid whey and manure (10,000 gallons/acre) on silt loam soils as influenced by % solids. Soil with excellent tilth would be expected to infiltrate more rapidly for a given solids content.

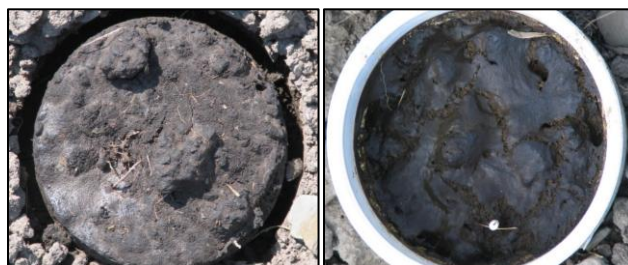


Figure 2: Comparison of the infiltration of 20,000 gallons/acre acid whey and manure. Whey (left) infiltrated completely in 10 minutes leaving a small amount of residue on the surface. Manure (right) at the same solids content (5.7%) infiltrated slower.

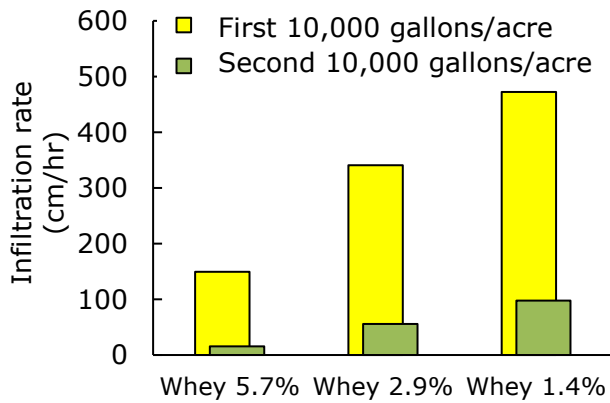


Figure 3: The 2nd 10,000 gallons/acre application infiltrated much slower than the 1st application of 10,000 gallons/acre.

Guidelines for Land Application

- If acid whey is mixed with manure and then land-applied, treat the mixture like straight manure.
- If acid whey is direct-applied to crop land:
 - Consider initial pH and the soils' ability to maintain pH in the optimal range for crop production. Additional lime will be needed to maintain soil pH over time for naturally acidic and poorly buffered soil.
 - Due to the pH swing within the first four weeks after application, avoid seeding pH sensitive crops directly after application.
 - Infiltration rates are impacted by soil type and initial moisture content; managing rates for quick infiltration and prevention of ponding of the acid whey in the field will reduce runoff risk.
- The Environmental Conservation Law of the State of New York (ECL) 360 regulation (non-recognizable food processing waste; 360 CRR-NY 360-4.2(b) and 4.6 (b)) states:
 - Limit rates based on chloride content and/or nutrient content.
 - For land-application of acid whey, the field slope of the receiving field must be less than 8% unless whey is injected parallel to the contour.
 - Ground water or bedrock must be greater than 24 inches below surface.
 - Apply only to sandy loam, sandy clay loam, loam, silt loam, silt, sandy clay and clay loam.
 - Apply no more than 16,000 gallons/acre in any 24 hour period.
 - Maintain the following setbacks:
 - Property line: 50 feet.
 - Residence, place of business or public contact area: 500 feet.

- Potable water well: 200 feet.
- Surface water and State-regulated wetland: 200 feet (waste not directly injected into the soil) or 100 feet (waste directly injected).
- Drainage swale: 25 feet.
- Land application to frozen ground is permitted if the slope of the field is less than 4% or the distance to a surface water or State-regulated wetland is at least 500 feet and berms are used.

Summary

Acid whey is a good source of nutrients for crops. Infiltration is more rapid than for manure, but acid whey may still pose a runoff risk when solids content is elevated and soil moisture content is high. Avoid seeding pH sensitive crops directly after application. Additional lime will be needed to maintain pH when acid whey is applied to naturally acidic and poorly buffered soils. Application rate can be limited by either nitrogen or phosphorus content of whey (based on crop needs and the New York phosphorus index), chloride content (not to exceed the 170 lbs chloride/acre annual limit set by ECL), or soil characteristics and conditions that regulate acid whey infiltration rates. Test whey and soils to set appropriate rates.

Additional Resources

- New York Solid Waste Management Facilities (Part 360; NYDEC); <http://www.dec.ny.gov/regs/2491.html>.
- Factsheet #33: Nutrient Management Planning; Factsheet #96: Acid Whey pH and Nutrient Content; <http://nmsp.cals.cornell.edu/guidelines/factsheets.html>.

Disclaimer

This fact sheet reflects the current (and past) authors' best effort to interpret a complex body of scientific research, and to translate this into practical management options. Following the guidance provided in this fact sheet does not assure compliance with any applicable law, rule, regulation or standard, or the achievement of particular discharge levels from agricultural land.

For more information



Cornell University
Cooperative Extension

Nutrient Management Spear Program
<http://nmsp.cals.cornell.edu>

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