



University of California Cooperative Extension

The Nuts and Bolts of Manure Water¹

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INTRODUCTION

Manure water irrigations are common in California. There are nutrients in manure water. There is no rule of thumb to account for these nutrients. In fact, nutrient content of manure water is quite variable. The most common questions related to manure waters are:

- 1) What's the actual nutrient content?
- 2) Are the nutrients as good as fertilizer?
- 3) Can I save money on my fertilizer bill?
- 4) How do I know how much goes on the field?

To answer these questions one can:

- 1) Sample manure water.
- 2) Incorporate results into crop nutrient management.

- 3) Alter manure water application to maximize nutrient use.

HOW TO SAMPLE PONDS

All ponds are not the same! The nutrient content of water in a dairy pond depends on the number of animals contributing to the pond, the presence or absence of a solids separator, the amount of fresh water added daily, and the amount of manure collected from each animal.

It is easiest to sample water as it comes out of the pond and drops into the irrigation system standpipe. In fact, it is more precise to estimate nutrient content from manure water leaving the pond than it is to sample water in the pond. In some instances, it is not easy to access manure water as it enters a standpipe. If that's the case, sample manure water as it enters crop fields. When sampling at an irrigation valve (instead of a standpipe) it is important to let debris in the pipeline pass through, and to be sure the water

¹ Poster presented at South Valley Dairy Day, January 12, 1995. Riverdale, CA.

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being sampled is full strength manure water (no dilution).

Containers should be clean and dry. A sample should be more than a pint and less than a quart. Water should be flowing for at least 10 minutes before sampling. Fill the container about two-thirds full. Freeze the sample immediately after sampling. The empty air space in the container will allow the water to expand without breaking the container. Check with your analytical laboratory to determine the proper sample size, and particular handling practices for the sample. Labs may have sample containers for use.

WHEN TO SAMPLE PONDS

Manure water should be analyzed from a pond during the spring dewatering. These waters are usually different than waters used during the summer months. The results of samples taken on the same day are similar. Yet, results of samples taken on different days are quite different. At this time, the recommendation is to sample the manure water during the spring dewatering every other day. One sample daily is thought to be enough. The average of the results should be used to estimate nutrient content of manure water.

Additional samples should be taken at least twice during the summer irrigations. If irrigation water is dumped into the pond, further sampling is recommended. This will improve the precision of estimating the nutrient content of the manure water. For instance, the nutrient content of the pond is reduced (diluted) when canal water is added. An acre-inch of water no longer provides the same amount of nutrients.

INTERPRETING LABORATORY ANALYSIS

The nutrient content of water should be converted into a useful number. Samples are usually analyzed for total nitrogen, ammoniacal nitrogen, phosphorus, potassium, salt (if a concern). Some elements on a lab report are reported in units of parts per million. Parts per million can be converted to pounds per acre-inch by multiplying the value by 0.2268. Elements

expressed as percentages can be converted to pounds per acre-inch by multiplying the value by 2268. Some nutrients may be expressed as milk-equivalents. These need special conversion values. The laboratory supplying the analysis or your local Soil and Water Advisor with Cooperative Extension can assist you with such conversions.

DETERMINING MANURE WATER FLOW

Determining pumping rate is easier said than done. Usual farm pump tests seldom include checking manure pumps. One challenge of getting a pump test done is the fact that manure water isn't clean and therefore dirties the individual attempting to install a metering device. Also, manure water has debris (straw, leftover feed, gloves, etc.) that will clog a typical propeller meter. Non-invasive meters can be useful for this task. These are expensive, but may be owned by someone at the irrigation district, the electric company, or the University of California Cooperative Extension Office. Pump testing of manure ponds should be done when the pond is at various depths. The amount of water in a pond alters the pumping rate.

CALCULATING NUTRIENT FLOW

After the sample results are received from the lab and the pump test results are known, it's easy to calculate nutrient flow. The calculation is as follows:

$$\text{Nutrients applied (lbs applied)} = \text{Nutrient content (lbs/ac-in)} * \text{amount of water (acre-inches)}$$

The estimation of acre-inches of water applied is the flow rate (gallons/minute)*number of minutes applied /27,154. For a pump that discharges 300 gallons/minute the calculation for 2 hours (120 minutes) is $300*120/27154 = 1.3$ acre-inches. The nutrients entering the field are divided by the amount of acres to determine the pounds of nutrients applied per acre of crop land.

An example of nutrients (pounds) applied to a field during a one hour irrigation is in Table 1. After 1 hour of pumping with a 100 gallons per

minute pump, and a nutrient content of 100 parts per million, 5 pounds of the nutrient entered the field. If the pump rate was 500 gallons per minute and the nutrient content was 100 parts per million, then 25 lbs of nutrients would enter the field. Note: these calculations are for a pump working 1 hour. Most irrigations are more than 1 hour.

Phosphorus, potassium and salts are usually in a plant available form. Nitrogen in the ammoniacal form (NH₄-N) can rapidly be converted to nitrate. Nitrate is the plant available form of nitrogen. In this sense, ammoniacal nitrogen is a fast release nitrogen and organic nitrogen is a slow release nitrogen source. The total remaining organic nitrogen can be converted to the plant available form over time (usually years).

Table 1. Amount of nutrients applied to a field (pounds) based on nutrient content of water (parts per million-ppm) and pump rate (gallons per minute-gpm). This assumes the pump ran for 1 hour.

Nutrient content (ppm)	100 gpm	300gpm	500 gpm
25	1	4	6
50	3	8	13
100	5	15	25
150	8	22	38
200	10	30	50
250	13	38	63
300	15	45	75

SUMMARY

Pond sampling is easiest to accomplish when water is leaving the pond. Samples should be put into a clean, dry container. Samples can be refrigerated and taken to the lab the same day or they can be frozen and taken to the lab at a later day.

Manure pumps should be evaluated for flow rate. This is not an easy task, yet it is vital to enable calculation of nutrient amounts going onto the field.

Nutrients in manure water can be applied to the crop nutrient needs. To determine application rates, soil sampling should also be done.

Contact your local Dairy Advisor if you are interested in cooperating in manure water research.