ON THE SOIL HORIZON
ANTHONY FULFORD AND JOY HOLLINGSWORTH
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Properties of Manure as a Nitrogen Fertilizer

Joy Hollingsworth[1], Anthony Fulford[2], Nicholas Clark[3], and Deanne Meyer[4]

Soil Quality & Nutrient Mgmt. Farm Advisors in [1]Fresno, Madera, Kings & Tulare and in [2]San Joaquin, Stanislaus & Merced, [3]Agronomy & Nutrient Mgmt. Farm Advisor in Kings, Tulare & Fresno; and [4]Livestock Waste Management Specialist UC Davis, UC ANR

You can fertilize your crops with manure and do it efficiently. You just need to have a good crop nitrogen management plan. A good plan starts with a budget. Know how much nitrogen is going in and coming out. The first inputs to look at are your irrigation water and your soil. You should be aware of how much residual nitrogen is in your soil, as well as the level of organic matter. Your outputs are what is in your crop. If your nitrogen inputs are less than your expected outputs, then you will need a fertilizer to fill that gap.

So how does manure fit into your nitrogen plan? Manure is an excellent source of nitrogen. It also has soil health and quality benefits such as increasing tilth, organic matter, and other important nutrients such as potassium and phosphorous. It is readily available if you own or are near a dairy. However, there are challenges to using manure as a source of nitrogen because it can be unpredictable in two ways.

First, a lot of the nitrogen in manure is in the organic form, which is unavailable to plants. Organic nitrogen can convert to plant available nitrogen at rates that are determined by several factors. These factors include soil temperature, texture, pH, and moisture content.

In This Issue

Anthony Fulford, PhD
UCCE Advisor
amfulford@ucanr.edu
(209) 525-6825
3800 Cornucopia Way
Suite A
Modesto, CA 95358

Joy Hollingsworth
UCCE Advisor
joyhollingsworth@ucanr.edu
(559) 241-7527
550 E. Shaw Avenue
Suite 210-B
Fresno, CA 93710

Second, the amount and type of nitrogen in manure changes from season to season and is affected by the source of manure and how it's handled. **Table 1**, from Pettygrove, Heinrich and Crohn (2009) shows how nitrogen mineralization (becoming plant available) varies. For example, if you apply 100 pounds of nitrogen from lagoon water and 100 pounds of nitrogen from corral manure, you are going to have a different result because they mineralize at different rates. The lagoon water will have more plant-available nitrogen sooner. Also, it's important to note that 40-70% of the mineralization occurs within the first 4-8 weeks. These large differences add to the unpredictability. Because nitrogen varies so much, it is important to test your manure at a commercial lab. Knowing how much nitrogen is in your manure, and what form it is in, can help you improve application efficiency. See the sidebar for more information.

Table 1. Guidelines for animal manure N mineralization in California (Pettygrove, Heinrich, and Crohn, 2009)

	Year 1	Year 2
	% applied organic N mineralized	
Dairy lagoon water	40-50	15
Dairy lagoon sludge and slurry; corral manure	20-30	15
Dairy mechanical screen solids	10-20	5

1. **40-70% of mineralization value will occur within the first 4-8 weeks following application (Andrews & Foster, 2007; Gale et al., 2006). It is suggested that the lower value (40%) be used for late fall or winter applications.**
2. **Dairy lagoon water N mineralization may be delayed if a significant proportion of solid particles remains on the surface of the soil, as may occur when lagoon water is applied without sufficient dilution with fresh water.**

Although manure is most commonly used in field crops, there are a variety of other crops that can benefit from it. One recent study showed that composted dairy manure increased soil water content and water retention in a young almond orchard, especially when applied during the fall (Lepsch et al 2019). The fall timing of the application also reduces the food safety risk. Another study showed that a product of composted manure woodchips applied in almonds increased soil moisture content compared to the unamended control in sandy soil (Villa et al 2021). They also increased the soil organic carbon and total nitrogen in both sandy and loam soils. Soil organic carbon and total nitrogen were also increased by surface-applied composted dairy manure in another San Joaquin Valley almond study (Khalsa, Hart, and Brown 2021).

To summarize, manure has benefits such as nutrient content and organic matter, but the nitrogen content is highly variable. Nitrogen availability is inconsistent between locations, and can change between seasons and years. If you're using manure to fertilize your crops, it is important to have it tested at a commercial lab. Check out the links in **Table 2** to find resources that provide information on sampling, calculating nitrogen inputs and outputs, and more.

Table 2. Resources

Description	Link
Nitrogen budgeting for forage crops receiving dairy manure	http://manuremanagement.ucdavis.edu/files/134370.pdf
How to calculate available nitrogen in your irrigation water	https://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=9361
How to soil sample for agronomic manure management	http://manuremanagement.ucdavis.edu/files/134371.pdf
How much nitrogen is in crops	http://geisseler.ucdavis.edu/Geisseler_Report_2016_12_02.pdf
Tool for wheat growers to estimate nitrogen requirements	https://smallgrain-n-management.plantsciences.ucdavis.edu/?page=about_page.
Fertilization guidelines	http://geisseler.ucdavis.edu/Guidelines/Home.html.

UC ANR Evaluating Chemical and Physical Properties of Manure

The California Dairy Research Foundation funded our group to research chemical and physical properties of manure. Sampled dairies span the San Joaquin Valley and have different ways of handling manure. These include solids separators, composting, vacuums, digesters, and more. At each dairy, manure was collected and tested. We're learning a lot about how manure varies. For example, we saw that at different times of year the manure had different properties on the same dairy. You can find out more information about digesters in this article. https://ucanr.edu/sites/Dairy/newsletters/California_Dairy_Newsletter90461.pdf, and vacuum dairies in this article https://ucanr.edu/sites/Dairy/newsletters/California_Dairy_Newsletter89641.pdf, from issues of the Golden State Dairy Newsletter.

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Sources

Andrews, N., & Foster, J. (2007). Organic fertilizer calculator. *A tool for comparing the cost, nutrient value, and nitrogen availability of organic materials. Oregon State Univ. Extension Service. EM*.

Gale, E. S., Sullivan, D. M., Cogger, C. G., Bary, A. I., Hemphill, D. D., & Myhre, E. A. (2006). Estimating plant-available nitrogen release from manures, composts, and specialty products. *Journal of Environmental Quality*, *35*(6), 2321-2332.

Khalsa, S. D. S., Hart, S. C., & Brown, P. H. (2021). Nutrient dynamics from surface-applied organic matter amendments on no-till orchard soil. *Soil Use and Management*.

Lepsch, H. C., Brown, P. H., Peterson, C. A., Gaudin, A. C., & Khalsa, S. D. S. (2019). Impact of organic matter amendments on soil and tree water status in a California orchard. *Agricultural water management*, *222*, 204-212.

Pettygrove, G. S., Heinrich, A. L., & Crohn, D. M. (2009). Manure nitrogen mineralization. *Manure Technical Bulletin Series. University of California Cooperative Extension. Available online: http://manuremanagement.ucdavis.edu*

Villa, Y. B., Khalsa, S. D. S., Ryals, R., Duncan, R. A., Brown, P. H., & Hart, S. C. (2021). Organic matter amendments improve soil fertility in almond orchards of contrasting soil texture. *Nutrient Cycling in Agroecosystems*, 1-19.

IRRIGATION & NUTRIENT MANAGEMENT WORKSHOP

Thursday, October 28th, 2021 from 8:30am – 1pm

Madera County Farm Bureau – 1102 S Pine St, Madera, CA 93637

This workshop will cover topics that teach irrigators to utilize technology to minimize nutrient loss and optimize irrigation efficiency!

AGENDA:

8:30am – 8:45am	Welcome, Introductions, and Registration
8:45am – 8:55am	Trina Walley Funding and Programs
8:55am – 9:10am	**Stacy Shutts American Farmland Trust on RCPP** Nine partners in the San Joaquin Valley are working together to support producers. Conservation plans, practice implementation, and conservation easements are several forms of assistance that the SJV Land and Water Conservation Collaborative will facilitate. A five-year Regional Conservation Partnership Program award through NRCS will provide funding for this technical and financial assistance.
9:10am – 9:30am	**Improving Your Farm's Ability to Sink Water** **Priscilla Baker, Acting District Conservationist, USDA Natural Resources Conservation Service** Review water and soil conservation practices farmers can use in Madera County to maximize their land's ability to absorb and infiltrate water, including examples from local growers.
9:30am – 10:15am	**Irrigation Scheduling** **Dr. Khaled Bali, Irrigation Water Management Specialist, UCANR** Considerations to help identity yield thresholds and management allowable depletions using calculations of daily crop use.
10:15am – 10:30am	Break
10:30am – 11:15am	**Nutrient Management & Soil Health** **Rex DuFour, ARRA/NCAT** Creating and implementing a nutrient management plan to meet crop needs while protecting water quality improving soil health.
11:15am – 12:00pm	**Maintenance & Optimum Efficiency** **Domonic Rossini, Team Leader Agronomy West, Netafim USA** Review of common maintenance issues that lead to inefficient application of water and nutrients. Tips to keep system working at optimum efficiency.
12:00pm – 12:15pm	Lunch
12:15pm – 1:00pm	**Data and Irrigation Equipment** **Matt Angell Farmer, Irrigation Engineer/Pump Specialist, Automation/Software Developer** Using system information to determine application rate, record keeping knowing when to apply, how much, how long for your field.

UC CE UNIVERSITY OF CALIFORNIA Agriculture and Natural Resources Cooperative Extension

2021 Annual Alfalfa and Forage Field Day

NOTE: DUE TO COVID, PRE-REGISTRATION IS REQUIRED TO ATTEND
https://surveys.ucanr.edu/survey.cfm?surveynumber=35502

Thursday, September 23, 2021
UC Kearney Agricultural Research and Extension Center, Parlier
9240 S. Riverbend Ave., Parlier, CA 93648

7:00 AM	**Sign-in and morning refreshment**
8:00	TRAM LEAVES FOR FIELD TOUR Choosing Alfalfa Varieties for Pest Management and Quality in Relationship to Harvest Schedule – *Dan Putnam, UC Davis* Sorghum Deficit Irrigation – *Bob Hutmacher, UC West Side Research and Extension Center* Sorghum Varieties – *Bob Hutmacher, UC West Side Research and Extension Center* Winter Flooding and Summer Deficit Irrigation of Alfalfa – *Khaled Bali, UC Kearney Research and Extension Center and Dan Putnam, UC Davis*
9:50	TRAM RETURNS
10:00	Properties of Manure as a Fertilizer for Forages – *Anthony Fulford, UCCE Stanislaus*
10:15	SJV Forage Crops Professionals Needs Assessment – *Nick Clark, UCCE Kings*
10:30	New USDA-ARS Efforts in Forage Research at San Joaquin Valley Agricultural Sciences (SJVAS) Center, Parlier, California– *Jason Kelley & Sultan Begna, USDA-ARS*
10:45	**Discussion**
11:00	**Break**
11:15	Pesticide application safety and PPE requirements – *Shawn Athayasay, Fresno County Agriculture Commissioner's Office*
11:30	Forage IPM Principles and Best Practices – *Michelle Leinfelder-Miles, Farm Advisor, UCCE San Joaquin*
11:45	Weed Management in Established Alfalfa – *José Luiz Carvalho de Souza Dias, UCCE Merced*
12:00 PM	**Discussion**
12:15	**Lunch**

DPR, CCA and N Mgmt. CEU hours have been applied for. Thanks to our sponsors: BASF and Innovative Ag Services

Timelines and Deadlines for the Healthy Soils and SWEEP Programs

Tentative Timeline for the Healthy Soils Program

CDFA website: https://www.cdfa.ca.gov/oefi/healthysoils/

Item	Estimated Timeframe
Public comment period for draft Request for Grant Applications	September 2021: *take this time to read over the requirements*
Application submission period	October 2021 – February 2022
Review and awards	October 2021 – March 2022: *this seems very optimistic, but the CDFA might be awarding projects on a first- come, first-served basis. Get your applications in early.*
Projects begin implementation	January 2022 onwards: *again, this seems very optimistic, since the CDFA moves very slowly with grant executions.*

Tentative timeline for the State Water Efficiency & Enhancement Program

CDFA website: https://www.cdfa.ca.gov/oefi/sweep/

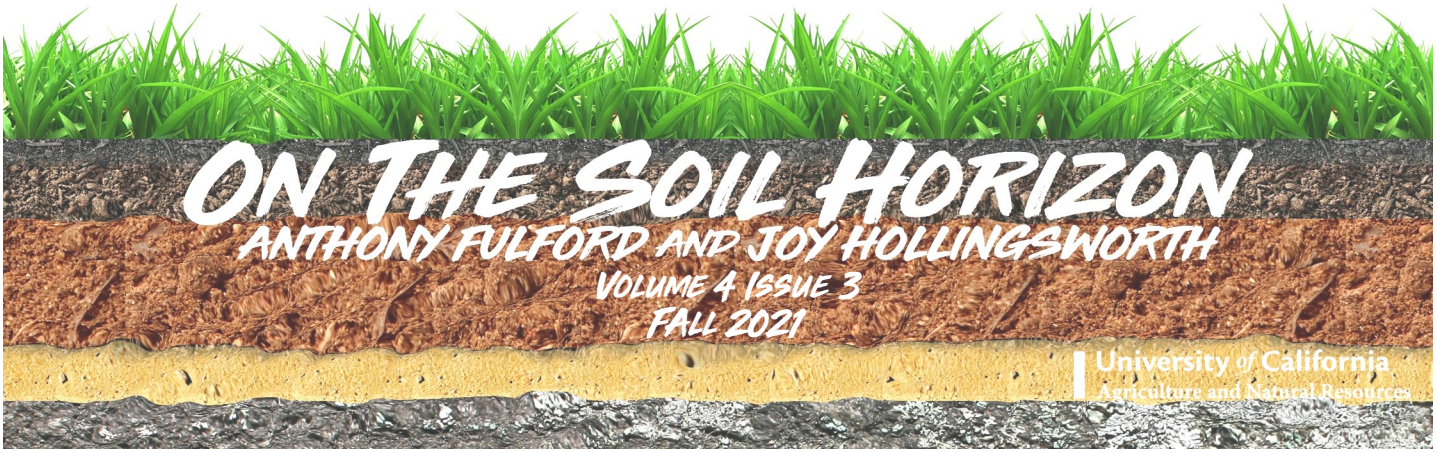
Item	Estimated Timeframe
Public comment period for Request for Grant Applications	September 2021 – October 2021: *take this time to read over the requirements. Get quotes and a pump efficiency test as needed.*
Application submission period	October 2021 – December 2021
Review and awards	October 2021 – January 2022: *this overlaps with the application submission period, so the CDFA might be awarding these grants on a first-come, first-served basis*
Projects begin implementation	Summer 2022

Questions? Reach out to Sami Budhathoki at sbudhathoki@ucanr.edu.

Cover Crops and Water

Interested in cover crops but worried your field doesn't receive enough rainfall? Community Education Specialist 2 Shulamit Shroder planted 5 different cover crop mixes in Shafter, CA, to see how well they would do under irrigated and non-irrigated conditions.

Check out the video here: https://www.youtube.com/watch?v=RIueBDKpu2M



Anthony

Anthony Fulford, PhD
Nutrient Management and
Soil Quality Advisor
UCCE Stanislaus County