Application of Biodigestor Products in Agriculture

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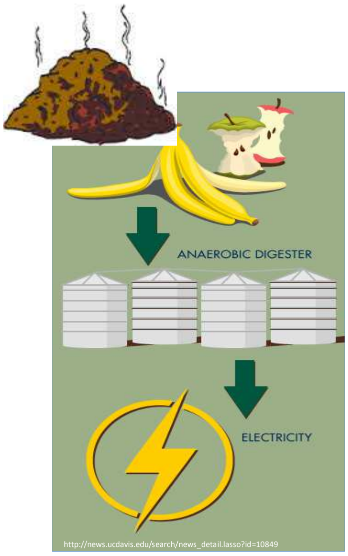

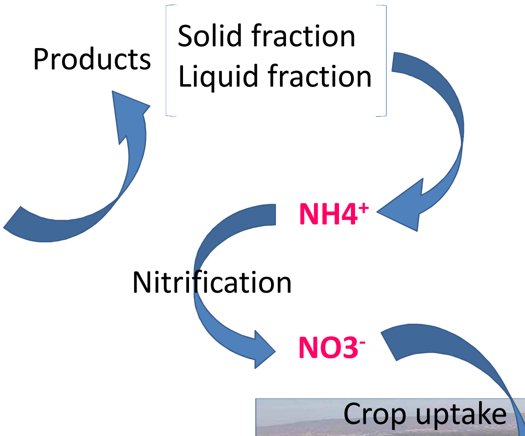

Figure 1. Nitrogen source from the anaerobic biodiigestor to the field (Russell Ranch).

Introduction

There is an increasing need for better waste management for organic wastes. Recycling waste products can increase crop yields while reducing external inputs such as fertilizer and water and also reduce pollution from agricultural systems. Dairy manure and food waste are two potential feedstocks for conversion to a soil amendment (both solid and liquid). Anaerobic digestion allows the capture of methane and electricity, but conserves nitrogen in the digestion process, which remains reduced as ammonium cation ($NH4^+$) (**Fig. 1**). Use of these biodigestor products in agricultural systems needs careful evaluation, however, for their long-term effects on crop yield, soil salinity, soil microbial communities and the nitrogen release curves of these products.

Goal

Evaluate the solid and liquid fraction from the anaerobic biodigestors as fertilizers and test their fertilization potential.

Reduce waste and gas emissions, recycle materials, generate energy while recovering plant nutrients and water.

Reducing losses of carbon, nitrogen and water in Agricultural Ecosystems.

Figure 2. New Hope biodigestor.

Material and methods

2 biodigestors (Fig. 2 and 3):*New Hope (source of material is* dairy manure) and *UC Davis (READ) (*food waste). Evaluate multiple products in year 1 and scale up to field-scale application in year 2.

Field experiment:

We apply 155 lb N/acre from different sources (Table 1) to different micro-plots in the biodigestor plot at Russell Ranch Sustainable facilities (*UC Davis*). We have planted tomato plants in a furrow irrigated field. Next year, we will repeat the trial in drip sub-surface irrigation field.

The treatments are (Fig. 4): solid fraction and liquid fraction from each biodigestor. We have three controls: 0 fertilizer application, chemical fertilizer as UAN32, and poultry manure compost (Table 1).

Although the calculated SAR of the product diluted in irrigation water should allow for full nitrogen application, we include a rate trial to test the effect of the salinity in the yield and in soil properties (Fig. 4).

We will determine the soil microbial community, the mineralization and nitrification of the nitrogen, and the nitrogen uptake in plants, by measuring the nitrogen and carbon percentage in plant samples.

Figure 3. READ biodigestor from UC Davis.

	units	New Hope solid fraction	READ solid fraction	New Hope liquid fraction	READ liquid fraction	Compost
TKN	%	6,310	4,727	0,133	0,297	2,490
Phosphorus	%			0,018	0,039	1,110
Potassium	%			4,419	1,638	1,860
Sodium	%			1,033	1,095	0,702
Calcium	%			0,123	0,062	3,200
Magnesium	%			0,588	0,019	0,708
Boron	ppm			0,004	0,001	78,900

Table 2. Nitrogen and other nutrients and cations present in the products from biodigestor, and in the poultry manure compost.

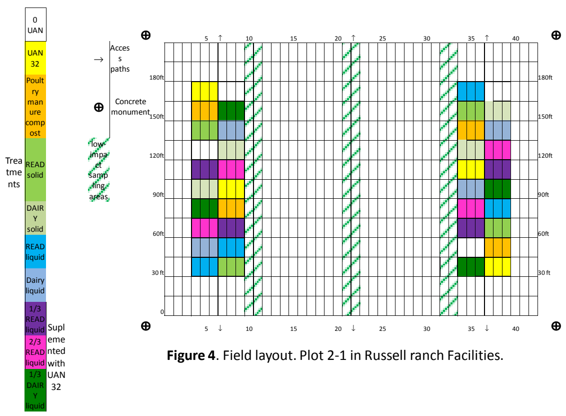

Figure 4. Field layout. Plot 2-1 in Russell ranch Facilities.

Poultry compost	UAN32	Control	Dairy solid	Read solid	Dairy liquid	Read liquid
	(lb/acre)				(gallon/acre)	
7619,22	484,38	0	4722,92	2478,78	13933,31	6262

Table 1. Quantity of each product applied in the field experiment

Soil lab incubations:

We will conduct incubations of soil with the same treatments that are in the field except the trial for salinity (image 3). We will mix 2mm sieved soil with each product in jars, raising the 60% of WHC. We will incubate the soil samples at 20ºC and keeping the moisture constant, adding water if it is necessary .We will take soil samples to determine the mineralization of nitrogen in each jar through the time.

Image 3.. Soil incubation in jars.

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