

Nutrient Recycling From Dairy Manure Made Easy

Project Proposal

Prepared for: Environmental Protection Agency - Nutrient Recycling Challenge

Prepared by: Jason Fuller, Carbon Cycle Consulting January 2, 2016



Compost Row Turning



Automated Screw Type Compost Turner

Finished Products



Finished Dairy Compost



Compost used as Freestall Bedding



DTA Carbon Cal

EXECUTIVE SUMMARY

Objective

Grown from a custom manure hauling company, Carbon Cycle Consulting challenges the status quo of the manure handling industry. We discovered a niche market by finding cost-effective measures to unlock and utilize the nutrient value of the dairy farm waste stream by creating value-added products and services to increase the profitability of the dairy farm—while protecting the natural resources of the watershed.

Goals

We are currently working with multiple dairy farms to create an “on the farm-site” composting program to achieve the following goals :

1. Reduce the amount of liquid manure handled and applied to the land.
2. Reduce the potential for groundwater contamination.
3. Create a value-added soil nutrient amendment that will eliminate application of raw manure directly to the soil.
4. Build humus in the soil by composting raw manure with other carbon-rich waste materials already owned by the farm.
5. Generate a revenue stream for the dairy farm by creating a secondary marketplace to sell value-added carbon and calcium based soil amendments to other cash crop producers who have not had access to animal manures.
6. Reduce the cost of handling of manure by accessing the volume reduction benefit of composting.
7. Partnering with dairy producers to work within their budget, existing infrastructure and abilities to develop a convenient, cost-effective composting plan of action, servicing their needs with our compost turning and spreading equipment.
8. Create a composted bedding alternative product to sand bedding for loose housing and free-stall barn operations.

Solution

After several years of experimenting and following a protocol from Dimond T Ag (www.dta-cal.com), we have been able to achieve all the above stated goals. Through a license agreement with Diamond T Ag (DTA), we have been able to use their knowledge base and recipe to create and market DTA Carbon Cal to other cash crop producers. DTA Carbon Cal is a carbon-based soil amendment that is created on the farm by aerobically composting dairy manure along with specific forms of calcite and other micronutrients to create a more biologically sustainable and

CARBON CYCLE CONSULTING

biologically available product. The method developed by DTA changed the value of manure from a liability to an asset for that farm. We have also seen a direct increase in the yield where the product is applied, thereby decreasing the cost of production for those crops. DTA Carbon Cal is typically applied to fields with a tillage pass to increase the soil's fertility. This product can also be applied directly to growing crops without damaging or burning the plants. Growing crops like alfalfa benefit from the increased microbial activity in the soil and grow to higher and healthier production levels than previously achieved with raw manure.

As a secondary benefit, we discovered that if we harvest our compost windrows before the completion of the carbon cycle, we are able to create a stabilized "clean" bedding material for use in both loose housing and in deep-bed free-stall barn applications. This frees the dairyman from having to use expensive bedding materials such as sand — which is abrasive to manure handling equipment, as well as animals, and has little to no soil building benefit.

Project Development

Since every dairy farm has an existing budget for manure handling and fertilizer acquisition needs, we discovered potential and opportunity while working within those budgetary constraints. In many cases, we can easily build upon their existing manure handling infrastructure. Some farms simply store their manure in lagoon style storage systems while others may have more elaborate systems that separate the waste streams into different components for handling ease. We can work with either situation.

For the dairy farms that have already invested in the infrastructure to separate their manure stream, the process to create compost windrows is simple: mix and blend the waste products with their existing feedstocks to achieve the workable carbon to nitrogen ratio needed to start the composting process. Once we locate a suitable target area to make compost windrows, we can start turning the windrows with the windrow turners.

For the farms that have lagoon style systems, we have been developing a way to create a compost product that utilizes an easily scalable-to-size technique that we call "evaporation lanes". We know that lagoon dairy manure is 90% or more water, but we also know that we can start the composting process with product that is 65% moisture. To achieve moisture reduction, we replicate the evaporative effect we have observed while land applying liquid manure in certain field conditions. We utilize the farm's existing high carbon content feedstock such as calf pen manure which usually has high amounts bedding like wheat straw, corn fodder, or wood shavings to create a base that is 6"-12" deep, 30-50ft wide and 200-300ft long. This gives us the desired vertical profile to be able to apply a light coat of liquid manure across the top of the base.

Giving vertical structure to the base allows water in the manure to evaporate, thus leaving the manure solids behind. With a reduction in moisture content, we can start the composting process as we build mass to our evaporation lanes with subsequent daily addition of product. A slight fluffing and addition of more high carbon

CARBON CYCLE CONSULTING

product like pen pack manure—as it is produced—allows the process to continue until there is a mat of about 3-4ft thick. At this time, the evaporation lane is pushed together on both sides to resemble a windrow that is 6-7ft tall, 14-15ft wide and 200-300ft long. Next, we start actively turning the windrow with one of our tractor powered mobile compost turners. By having the carbon to nitrogen ratio around 25:1 we have noticed that within a day or so the smell associated with raw manure is eliminated. We monitor the temperature and as time progresses, the microbial activity increases and we are able to see a drastic reduction in volume within a few short weeks. We will turn the windrow 8 to 12 times in a 3 to 5 month duration until the row has been digested by microbial activity and converted into a dark, black humus rich product.

Once 2 months have passed, we can make the determination to make the compost into bedding or soil amendment. If we choose to make DTA Carbon Cal, it is at this time during the exothermic decomposition process that we add the calcite and micronutrients so that the microbiological activity in the windrow can utilize the nutrients into making plant available compounds. We land apply the product on the producing dairy farm to correct the fertility deficiencies as revealed in their soil tests. Once these needs are met, if there is an excess of product produced we can also generate revenue for the producing dairy by marketing the product to other cash crop producers.

Despite the industry practice of applying raw manure at rates of 40 ton per acre or more, we have found that we are able to achieve very noticeable agronomic results by applying DTA Carbon Cal with application rates of only 500# to 1000# /per acre. This has opened up the prospect of being able to economically ship the product to other fields off the farm or even several hundred miles away affecting the cost per acre by only a few dollars. For example, a semi-truck load of product weighing 25 ton would treat 100 acres of corn ground at 500#/ acre. A retail price for a 25 ton semi-truck load of product sold and shipped to a cash crop producer in a different watershed 100 miles away would be approximately \$3500 leaving the cost per acre to be only about \$35/acre. A very welcome and affordable option for the cash crop producer that is trying to balance variable input prices and shrinking profit margins.

GROWTH REQUIRES AUTOMATION

The mobile system we have put together has been well received. With our print advertising and our website www.agcarbonrecycling.com we aim to change the future of manure handling for our clients in the dairy industry. The challenges and successes we've seen with the mobile system have taught us many lessons. It's become obvious that we can now harness the power of Biology through composting to completely eliminate the use of liquid manure on a large scale dairy facility. Clearly, in order to economically handle the large volumes of waste created by a large dairy, we need to move to the next stage and automate our process. Currently, there are multiple examples throughout the world of automated composting systems that can be efficiently built and economically operated. The move to automate the process frees us from the constraints of labor shortages and

CARBON CYCLE CONSULTING

weather delays but also allows us to reduce the actual production time of creating a finished product from 3 to 5 months to only 60 days or even less if we are making a bedding product.

This step to automate the process opens up the opportunity to invite off-farm investor partners. By working together, we can actively participate in cleaning up our watershed and protecting our natural resources with a true win-win relationship for all parties involved.

With a well funded investment team, we can develop a plan to build a composting facility and work with a large dairy farm partner who would supply their manure stream. This would be processed into composted products that we can then market to other end users affordably, in an ecologically sound method and with a track record of already market proven and tested products.

After the facility is built and operational, there could be the potential opportunity to sell the facility back to the operating farm freeing up the investment capital to target another dairy and build another facility. Ultimately, a network of dairies could be built with automated composting manufacturing facilities in place.

Building a network of on-farm facilities to produce a consistent stream of high quality, environmentally friendly, biologically sound products would allow us to change the way manure is viewed in the marketplace. A marketing agreement would be drafted to allow us the right to market finished product to a virtually unlimited market base of cash crop producers. Additionally, there may be other industries that would be a natural outlet for these kinds of products such as landscapers and DOT road building projects. This marketing agreement could be considered very similar to the existing marketing structure of the milk cooperatives that already process and market milk from the dairy farm.

Some of the benefits of creating a composted product are:

1. Little to no offensive odor while processing.
2. No odor while applying product to fields.
3. Risk of environmental contamination is greatly reduced.
4. NPK & other micronutrients found in raw manure are converted to more biologically stable compounds.
5. Finished compost is easily stored and transported with no specialized equipment.
6. Potential to be used as an unlimited re-usable bedding source.
7. Easily create value added products like DTA Carbon Cal with the addition of minerals.
8. Manure handling system can now be considered a potential revenue generator like the milking parlor.
9. No need to build bigger liquid manure storage lagoons, which inherently collect even more rainfall, adding to the cost of manure hauling.

BUDGETING FIGURES TO CONSIDER

Current Market Pricing

Let's look at some real world examples of our sales experiences in the market place combined with the expected potential of an automated facility on a 2000 cow dairy producing finished dairy compost and a value added product like DTA Carbon Cal.

Description	Ton	Retail Price
Humus based Dairy Compost	1	\$ 25
DTA Carbon Cal product	1	\$ 120
Daily retail potential of facility design on a 2000 cow Dairy Compost	60	\$ 1,500
Daily retail potential of facility design on a 2000 cow dairy DTA CarbonCal	120	\$ 14,400
Yearly gross production potential in Dairy Compost sales retail	21,900	\$ 547,500
Yearly gross production potential in DTA Carbon Cal sales retail	43,800	\$ 5,256,000

Products Currently Produced



Humus based dairy compost



Compost as free stall bedding



DTA Carbon Cal

VISION FOR THE FUTURE

Presently, there are many different approaches to handling manure currently being considered in animal agriculture ranging from simple storage systems to elaborate and costly methane-capturing digesters for electricity generation. The system we've been growing is the most cost-effective by being able to produce products that are multipurpose and environmentally stable. With the right investment partner, we would be able to generate an increase in revenue within a few short months of being operational. Not only is Carbon Cycle Consulting a dealer for DTA, but the network of independent dealers associated with Diamond T Ag is growing every year and currently serves agricultural markets in at least 7 states. This alliance and network provides opportunity for wholesale sales to other dealers in the DTA network — enhancing the efforts of our own direct retail sales and building clientele both locally and in other markets.

Investment in our venture could be as simple as funding raw materials such as calcite purchases or as elaborate as a commercial real estate project where the investor funds the building of a complete composting facility at one of our 2000 cow partner dairy farm sites. Perhaps even, a potential investor would have the skill set in marketing to enhance the sales process with a direct advertising campaign to reach out to potential clients more effectively.

Professionally, I have over 20 years of agriculture and financial sales-related experience. And, from personally growing up on a 5th generation dairy farm, I witnessed that cooperative efforts in agriculture have long been an accepted business practice and have served agriculture well. I certainly think that this process could open up the opportunity to off farm investors and extend that cooperative spirit to work hand in hand to bring about the change that the agriculture industry is desperately needing. Truly, we believe the answer lies in a better understanding of the biology of manure and allowing that biology to take the lead in “Nutrient Recycling, Made Easy”.

I welcome your questions and interest. I can be reached at:

Jason Fuller
Carbon Cycle Consulting
fuller.jason@yahoo.com
608.370.4926
933 Grignon St
Kaukauna, WI 54130

www.agcarbonrecycling.com
www.dta-cal.com



Finished compost land applied