Dairy Lagoon Nutrient Extraction with Vermicomposting

WORC Annual Conference

Introduction of Royal Dairy, home of the Worm BIDA system

General Challenges of Dairy Industry

Solutions to Royal Dairy...worms

How BIDA works

Byproduct-Worm Castings

Worm Casting Applications

ROYAL DAIRY OVERVIEW

350,000 lbs of milk a day

850,000 lbs of feed per day

750,000 lbs of manure created per day, including winter months

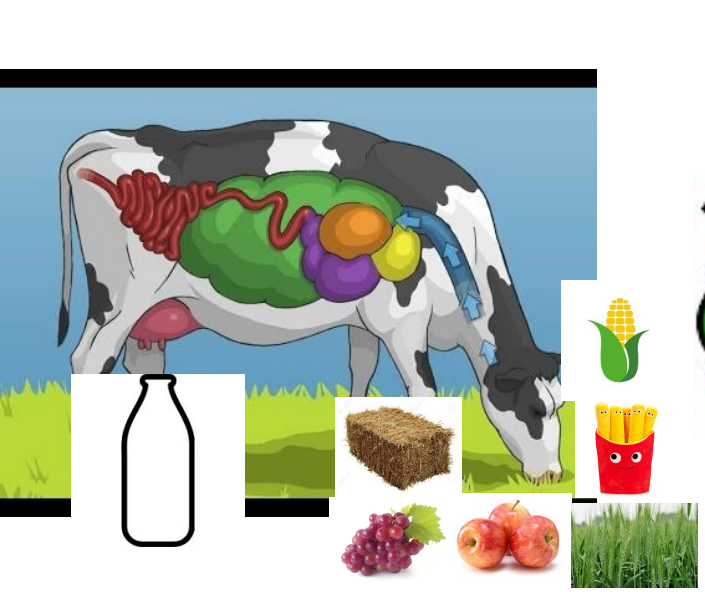
150,000 gallons avg of new water used daily for cows drinking and parlor cleaning

All water that comes on our dairy footprint either flows to our capture system or our asphalt containments and is then put through the process

Dry cows and young stock raised on site

⅔ Free stall flush ⅓ open lot vacuum

Cows Eat Animal Feed and Poop Plant Feed



COWS ARE CRUCIAL TO SUSTAINABLE AGRICULTURE!

WE NEED TO UTILIZE THE NUTRIENTS FROM COWS BETTER, ESPECIALLY THAT WITHIN THE LIQUID

Getting More Out of Liquid ManureUtilizing Feed

Feed	Manure	Milk
67% Expenses	8% Expense	98% Revenue98% Revenue

8% Expense on Liquid Manure

The cow's digestive process turns that feed into a valuable soil feed, we need to figure out how to process and utilize it better

Most of that expense is in the liquid manure, solid manure turned to compost is a break even for the dairy, is an asset to the farm but not enough to pay the dairy much on top of handling cost

Goal is to take the nutrients out of the water and use them properly as an asset to create revenue and improve farming. Use the water for irrigation.


LARGE LAGOON
SETTLING POND
SOLID MANURE STACKING
SEPARATOR BUILDING
DISCHARGE PIT
SEPARATOR SOLIDS STORAGE AREA
RECEPTION PIT
SETTLING BASINS
FEED MIXING AREA
FREESTALL BARN 4
FREESTALL BARN 3
FREESTALL BARN 2
FREESTALL BARN 1
PEN 11 (MILKING COWS)
PEN 13 (SPRINGERS)
PEN 15 (SPRINGERS)
PEN 10 (MILKING COWS)
PEN 12 (DRY COWS)
PEN 14 (CLOSE-UP COWS)
CALF HUTCHES
CALF HUTCHES
PEN 21
PEN 24
PEN 27
PEN 29
PEN 20
PEN 23
PEN 19
PEN 26
PEN 18
FEED STORAGE
PEN 17
PEN 22
PEN 25
FEED BAGS
PEN 16
FLUSH TOWER
HOSPITAL BARN & PARLOR
CALVING BARN
CALF HUTCHES
EMPLOYEE HOUSES
WELL PUMPHOUSE
WEIGH SCALE
HAY FILE
HAY
SHOP
BACKUP WELL
MILKING PARLOR HOLDING AREA
CLEAN WATER POND (IRRIGATION)
PEN 30
PEN 39

Dairy Challenges

Lagoons.. likely the biggest challenge for a dairy farmer today

Agronomically disposing of nutrient rich dairy liquid

Lots of land needed, lots of trucks on the road, shipping lots of water

Pre worms=4,000 acres needed for 50,000,000 gallons of water a year

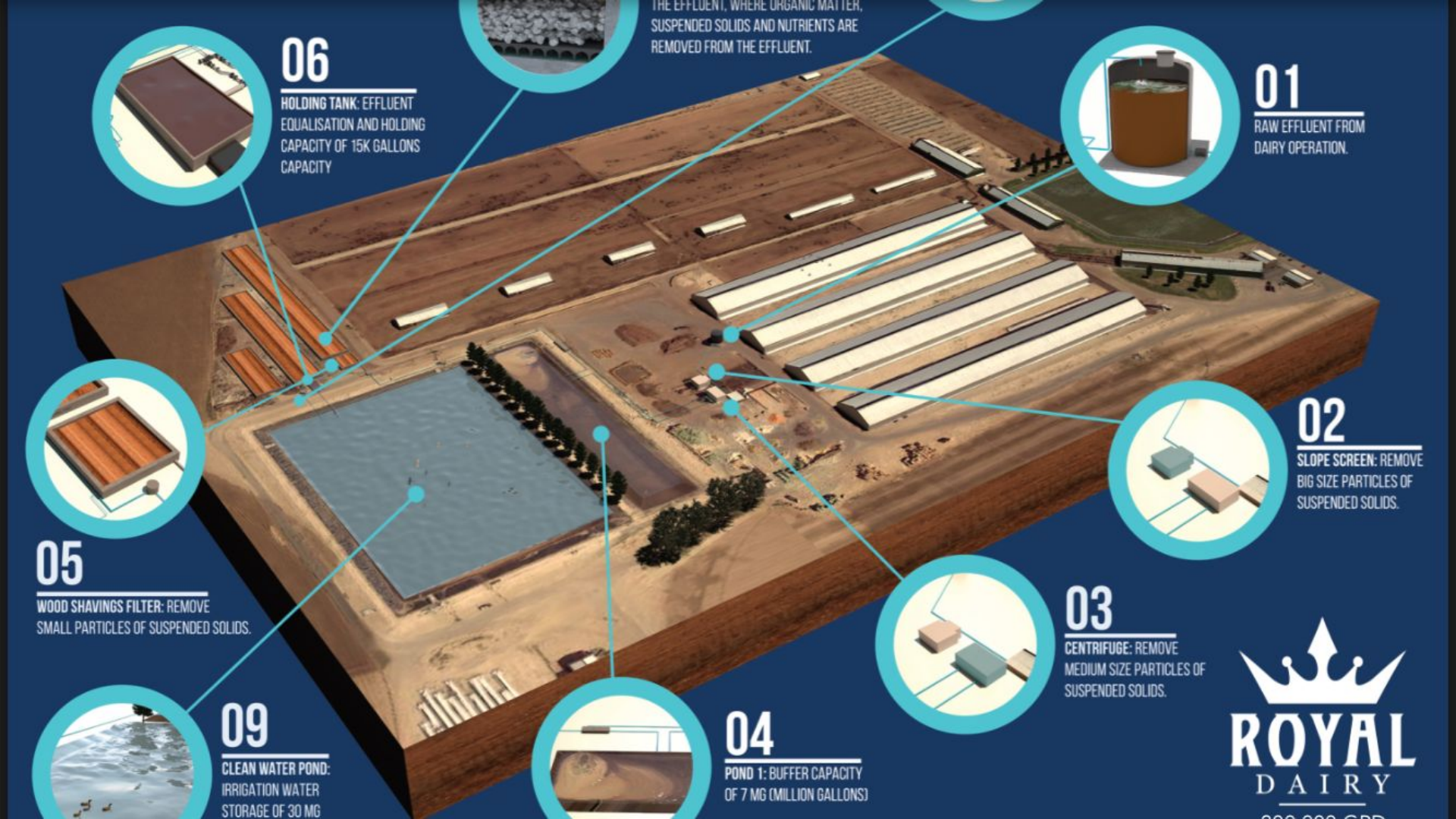
Jury is still out on Nutrient Dairy Water, Science still in the air to show how much is agronomical

Lagoon=biggest source of odor and methane gas on the dairy

Reusing dirty water to clean pens is less effective

Worms Pulling out the Nutrients

Through the Biological Passive Flow through the BIDA system the vast majority of these plant nutrients can be pulled out of the water and digested by worms to make a very effective plant food.


06
HOLDING TANK: EFFLUENT EQUALISATION AND HOLDING CAPACITY OF 15K GALLONS CAPACITY
THE EFFLUENT, WHERE ORGANIC MATTER, SUSPENDED SOLIDS AND NUTRIENTS ARE REMOVED FROM THE EFFLUENT.
01
RAW EFFLUENT FROM DAIRY OPERATION.
02
SLOPE SCREEN: REMOVE BIG SIZE PARTICLES OF SUSPENDED SOLIDS.
03
CENTRIFUGE: REMOVE MEDIUM SIZE PARTICLES OF SUSPENDED SOLIDS.
04
POND 1: BUFFER CAPACITY OF 7 MG (MILLION GALLONS)
05
WOOD SHAVINGS FILTER: REMOVE SMALL PARTICLES OF SUSPENDED SOLIDS.
09
CLEAN WATER POND: IRRIGATION WATER STORAGE OF 30 MG
ROYAL
DAIRY

How Biofiltro Works

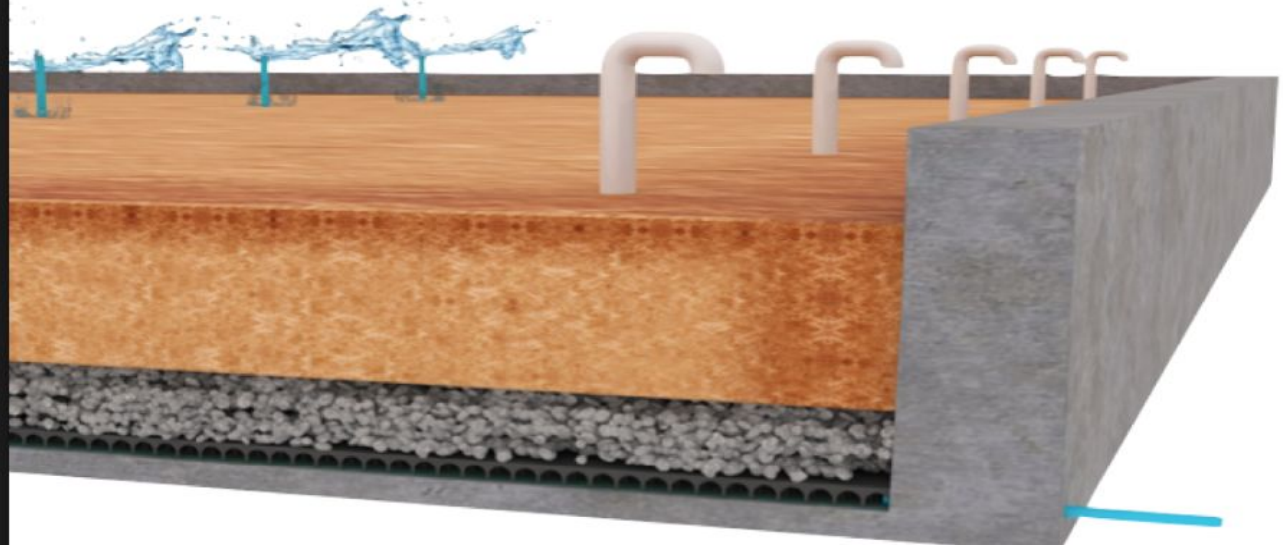
BIOFILTRO
IZE WATER

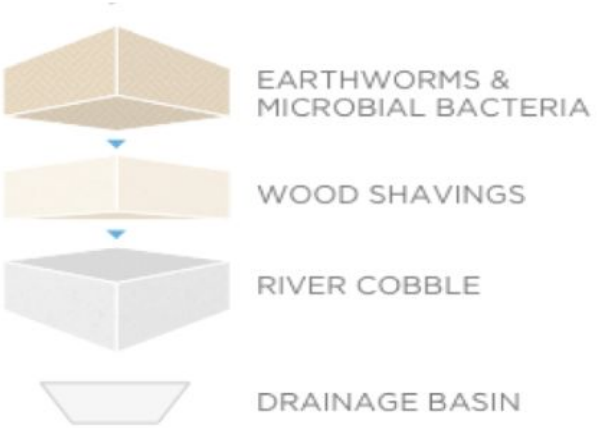
https://vimeo.com/214224089

BIDA® System Patented Process

"Method and system for inoculating bacteria in contaminated water using earthworm humus"

US 7,540,960
Filed in 2007
Issued in 2009





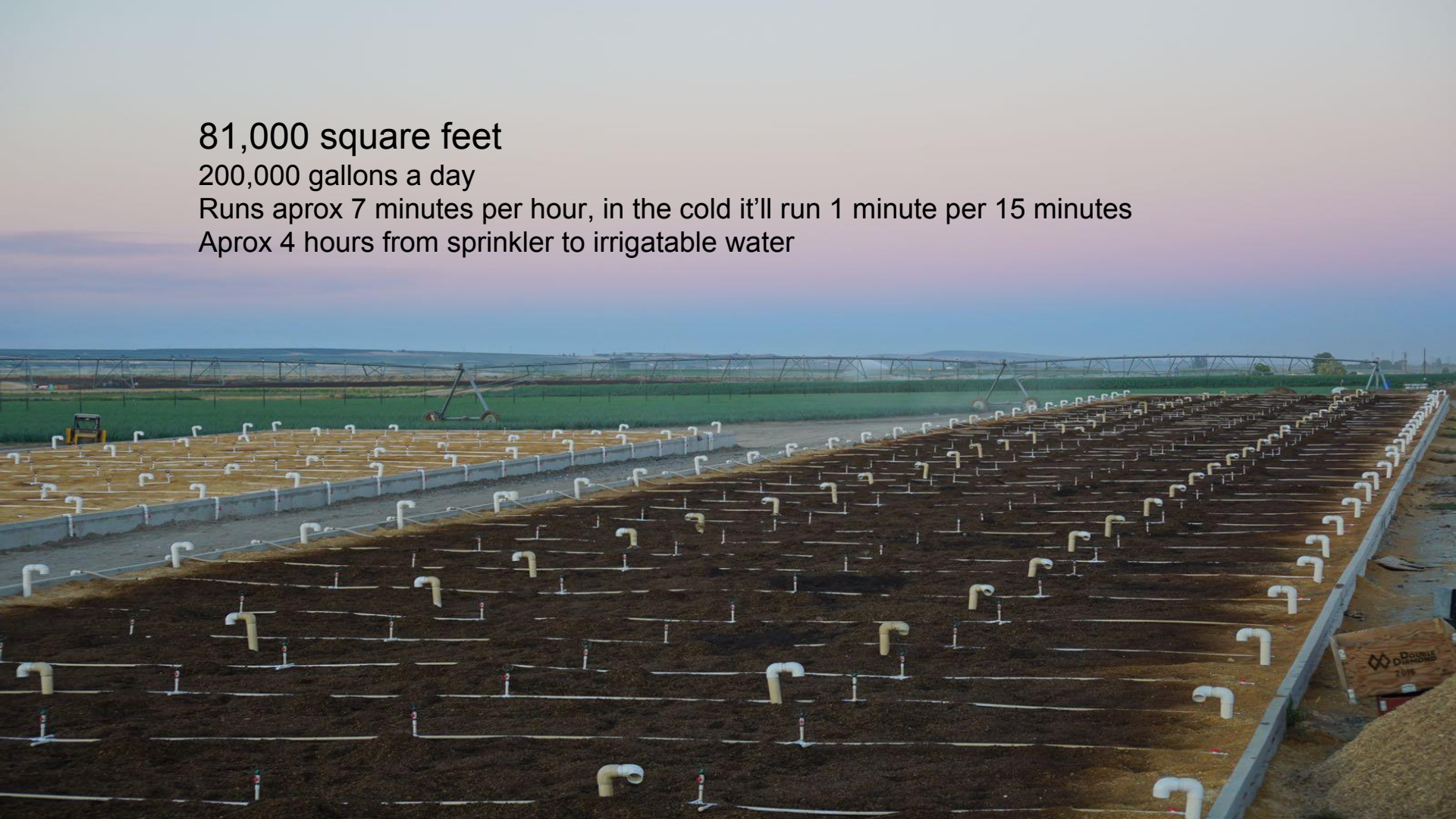

BIOFILTRO

81,000 square feet

200,000 gallons a day

Runs aprox 7 minutes per hour, in the cold it'll run 1 minute per 15 minutes

Aprox 4 hours from sprinkler to irrigatable water



At peak about 500 worms per square foot

BIOFILTRO
REVITALIZE WATER

The Biology Within

Worms

- Solids
- Burrow - Aerate and Saturate
- Neutralize pH (5 - 8)
- 6-10 year lifespan
- ~ 4 Cocoons Per Week
- Microbe rich castings - benevolent
- Stabilization

Industry Specific Microbes

- Target soluble and dissolved solids
- Billions of colonies

Symbiotic relationship forms biofilm, a dynamic external digestive layer, across the system medias for

Royal Dairy, Royal City, WA (2015)
Dairy Farm
Phase 1: 6,000 GPD
Phase 2: 200,000 GPD (To Be Completed in Summer 2017)

	LAGOON			AFTER BIDA			EFFICIENCY		
	TSS (mg/L)	TN (mg/L)	TP (mg/L)	TSS (mg/L)	TN (mg/L)	TP (mg/L)	% removal TSS	% removal TN	% removal TP
1	14,560	2,317		144	391		99%	83%	
2	19,940	2,582		1,620	116		92%	96%	
3		2,446			114			95%	
4	29,180	2,282		2,600	123		91%	95%	
5	35,320	2,428	412	290	90	77	99%	96%	81%
6	14,680	2,265	272	514	260	36	96%	89%	87%
7	23,860	2,302	303	332	175	15	99%	92%	95%
8	21,890	2,454	282	490	144	18	98%	94%	94%
9	25,200	2,036	327	278	126	21	99%	94%	94%
10	22,420	2,012	267	252	101	18	99%	95%	93%
11	13,060	1,771	290	447	115	32	97%	94%	89%
Average	**22,011**	**2,263**	**308**	**697**	**160**	**31**	**97%**	**93%**	**90%**

Water Treatment

Average of 10+ samples of pilot and full scale system

99% Removal of TSS

90% Removal of TN

70% Removal of TP

99% Removal of FECAL COLIFORM

70+% Reduction in Greenhouse Gasses

We treat aprox 200,000 gallons a day

4000 acres down to 250 acres needed for same amount of water

Castings

Take about 1 year for worms to convert the top foot of the filter to castings, this top foot is where a majority of the nutrients out of the water will be.

Harvest about 2,500 yards or 1,000 tons every 18 months

Harvest using an excavator we skim off the first 1’ - 2’ of casting on top of filter

We will then use a traumel screen to seperate out some worms and put them back in the system if needed

RAW Castings out of Royal Daiy 5,000 ft2 BIDA system at harvest

Assay Name	Result	Units	Desired Level	Commentary
Organism Biomass Data				
ght	0.61	N/A	0.20 to 0.80	Within normal moisture levels.
Active Fungi	**1.64**	µg/g	> 3.00	Fungal activity low, foods may be required. -
Total Fungi	**237.64**	µg/g	> 300.00	Low fungal biomass, inoculum and foods may be required. - Fairly good fungal diversity, hyphal diameter: 1.5 to 6um
Hyphal Diameter	2.90	µm	> 2.50	Good balance of fungi. -
Active Bacteria	38.05	µg/g	> 3.00	Bacterial activity within normal levels.
Total Bacteria	708.15	µg/g	> 300.00	Good bacterial biomass. -
Actinobacteria	15.03	µg/g	< 50.00	
Organism Biomass Ratios				
TF:TB	0.34		0.01 to 10.00	Balanced fungal and bacterial biomass.
AF:TF	0.01		< 0.10	Good fungal activity.
AB:TB	0.05		< 0.10	Good bacterial activity.
AF:AB	0.04		0.01 to 10.00	Bacterial dominated, becoming more bacterial.
Protozoa (Protists)				
Flagellates	76,028.77	number/g	> 10,000.00	Should provide a good inoculum of protozoa.
Amoebae	760,287.73	number/g	> 10,000.00	
Ciliates	4,577.24	number/g	< 8363.00	
Nitrogen Cycling Potential	300+	lbs/acre		Nitrogen levels dependent on plant needs. Estimated availability over a 3 month period
Nematodes				
Nematodes	**2.45**	number/g	> 10.00	Low numbers and diversity.
Bacteral	2.25	number/g		
Fungal	0.00	number/g		
Fungal/Root	0.20	number/g		
Predatory	0.00	number/g		

For many application fungi food would need to be added to make more effective plant enhancer

Nematode Detail

Report prepared for:
Biofiltro
Sina Pram
2911 E. Barstow
Fresno, CA 93740 USA
sina.pram@biofiltro.com

Report Sent: 07 Sep 2017
Sample #: 01-126032
Unique ID: Worm Farm Castings
Invoice Number: 15311
Sample Recieved: 25 Aug 2017

For interpretation of this report please contact your local Soil Steward or the lab.

 # per gram
Classified by type and identified to genus.
If section is blank, no nematodes identified.

Earthfort, LLC
635 SW Western Blvd
Corvallis, OR 97333
+1 (541) 257-2612
info@earthfort.com
http://earthfort.com

Nematode Genus	number/g	Units	Group	Common Name
Butlerius	0.13	number/g	Bacterial Feeders	
Cuticularia	0.07	number/g	Bacterial Feeders	
Diploscapter	0.40	number/g	Bacterial Feeders	
Monhystrella	0.46	number/g	Bacterial Feeders	
Rhabditidae	1.19	number/g	Bacterial Feeders	
Ditylenchus	0.20	number/g	Fungal/Root Feeders	Stem & Bulb nematode

35 Seeds to start

Castings Application

Use Raw Castings for more efficient plant growth

Mix castings with compost for agriculture application

Introduce fungi and other ingredients into castings to make a better casting

Use worm castings to make a worm tea

SUMMARY

After BIDA we have Clean Water to irrigate with through our circles

We have Castings and Compost to work with to advance our farming practices

We reduce our greehouse gasses and odor

QUESTIONS???

https://vimeo.com/214224089

https://vimeo.com/214224089


BIOFILTRO


CASE
CASE

Emissions: Filter