Commercial Application of Continuous Processing Equipment Corn Replacement Feed Technology

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Continuous Processing Evaluation

Three Grinding-Processing Trials in 2011

Haybuster 1150 Tub Grinder

Round hole screens evaluated:

3”, 5”, 7”

Application system developed

Lime solution applied at 5% wt:wt

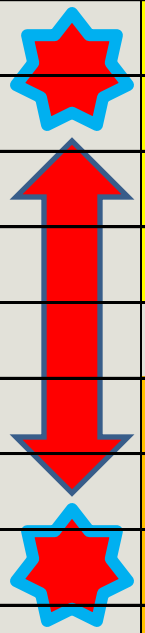
Measurements:

- Capacity (dry tons per hour)
- pH, moisture, calcium
- NDF and in vitro digestibility

Haybuster 1150 with bale picker


~ 20 to 60 dry tons treated per hour

AMANA FARMA - CaO + WATER CALCULATIONS									08/10/2011
				WET	DRY		MIX = 5.86 % CaO		7000
% MOISTURE OF CORN STOVER BALES				0.2	0.8			Gal/Min	X 94.14% H2O
					Tot. Mst Needed	Tot Wt.	8.47 lbs	ROUND	6590 Gal. H2O
BALE WT - LBS	DM	5% CaO	TDM	TM	TMN-50%		GAL	UP	
1250	1000	50	1050	250	800	850	100.35	101	6590 @ 8.34
1200	960	48	1008	240	768	816	96.34	97	54,961
1150	920	46	966	230	736	782	92.33	93	Div. by .9414
1100	880	44	924	220	704	748	88.31	89	58,382
1050	840	42	882	210	672	714	84.30	85	58,382 - 54,961
1000	800	40	840	200	640	680	80.28	81	3421 CaO
950	760	38	798	190	608	646	76.27	77	
900	720	36	756	180	576	612	72.26	73	3421 / 2
850	680	34	714	170	544	578	68.24	69	1710
800	640	32	672	160	512	544	64.23	65	@ 50 lb bags
750	600	30	630	150	480	510	60.21	61	34.2 bags
700	560	28	588	140	448	476	56.20	57	
650	520	26	546	130	416	442	52.18	53	
600	480	24	504	120	384	408	48.17	49	



GRUSBY - AMANA FARMS - 5 % CaO TREATED CORN STOVER - 3" - 5" & 7 " GRINDS											12/01/2011	
	TREATED STOVER FROM 09-15-11 pH					7.97		69 - 50 LB BAGS OF CaO UTILIZED				
STOVER BALES - AVERAGE OF 50 SAMPLES % MOISTURE						15.0		ph OF WATER FOR TANK				7.88
								pH OF TREATMENT LIQUID				12.35
NOTE : MISSISSIPPI LIME 7000 GAL TANK - 69 - 50 LB BAGS UTILIZED											LBS / MINUTE	
3" - CONTROL				5" - CONTROL				7" - CONTROL			SCREEN	LBS
SAMPLE	% Moist.	pH		SAMPLE	% Moist.	pH		SAMPLE	% Moist.	pH	3"	990
1	13.4	10.86		1	12.2	10.66		1	10.4	11.25	BALES	TIME
2	13.2	10.70		2	13.4	10.15		2	14.1	10.81	2495	2.50
3	13.2	9.71		3	15.6	9.98		3	12.1	10.4		
4	18.4	9.31		4	15.8	11.74		4	10.6	10.54	SCREEN	LBS
5	15.8	9.08		5	14.2	10.58		5	12.2	10.32	5"	984
											BALES	TIME
AVG.	14.80	9.93		AVG.	14.24	10.62		AVG.	11.88	10.66	2706	2.75
3" - TREATED				5" - TREATED				7" - TREATED			SCREEN	LBS
SAMPLE	pH			SAMPLE	pH			SAMPLE	pH		7"	2241.6
1	12.32			1	12.17			1	12.20		BALES	TIME
2	12.38			2	12.07			2	12.18		2802	1.25
3	12.18			3	12.12			3	12.23			
4	12.24			4	12.22			4	12.24		GALLONS / MINUTE	
5	11.98			5	12.09			5	12.28		(15% MOISTURE)	
6	12.07			6	12.31			6	12.32			
7	12.13			7	12.13			7	12.24		3"	93
8	12.10			8	12.23			8	12.27		5"	93
9	12.23			9	12.23			9	12.25		7"	214*
10	12.19			10	12.23			10	12.33			
											* PUMP	
AVG.	12.14			AVG.	12.18			AVG.	12.25		FLUCTUATIONS	

High capacity processing was achieved

Results for continuous processing (trial 3)				
	initial moisture, %	pH	Grinding results	
Screen, mm (in)			Capacity, as is lb/min	Dry tons/hour
76 (3”)	14.8	12.14	1,000	25.5
127 (5”)	14.2	12.18	980	25.3
178 (7”)	11.9	12.25	2,240	59.5

Fiber was solubilized and dry matter digestibility was improved…smaller screens produced better results

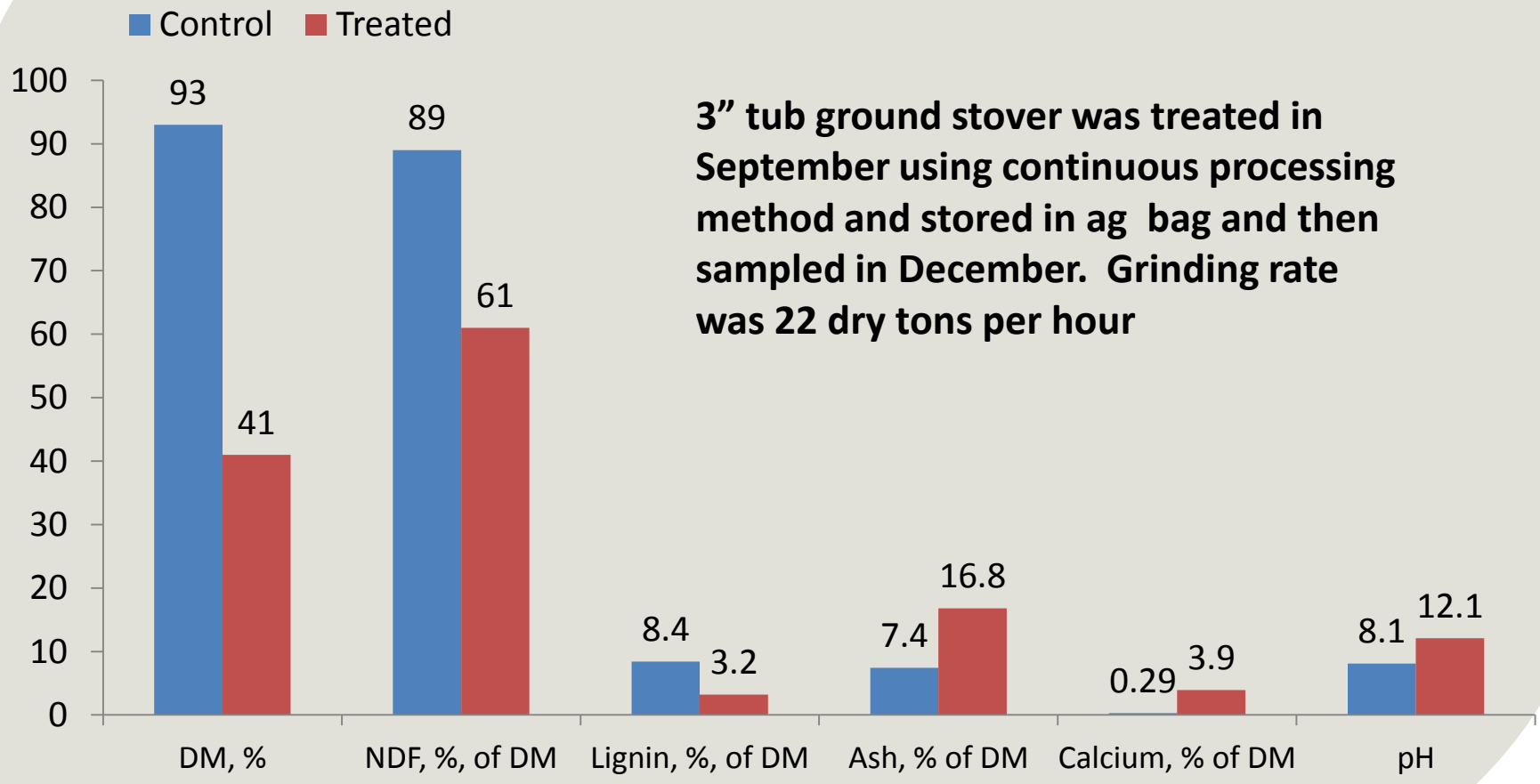
Characteristics of Corn Stover Treated by Continuous Processing Method

			NDF, % of DM			In Vitro DMD%			Improvement	
Tub Grinder Screen, mm (in)	MPS[1], mm		Control	Trt		Control	Trt		NDF solubilized, g/100 g	DMD[1] g/100 g
178 (7”)	18.9		78.6	68.2		65.4	69.2		10.3	3.7
127 (5”)	11.7		72.3	63.5		63.5	72.0		8.8	8.5
76 (3”)	11.8		78.6	63.4		60.1	71.6		15.2	11.5

[1] MPS = geometric mean particle size, DMD = dry matter digestion

[2] Separated by dry sieving in laboratory, Top Screen = >19mm, Middle Screen = 8 mm to 19 mm, Bottom Screen < 8 mm.

Recommended measurements



3” tub ground stover was treated in September using continuous processing method and stored in ag bag and then sampled in December. Grinding rate was 22 dry tons per hour

Mobile processing costs

COSTS
Incremental processing cost per dt
$18.50 (lime at $370/ton)
$20.00 (processing fee*)
$38.50 total

***estimate for application equipment and labor + margin. Assumes same grinding cost for control and treated stover (does not include storage cost)**

Lime: Safety Considerations

Respiratory Protection - Dust filter masks are recommended for personal comfort and/or protection

Protective Gloves – Cloth or leather gloves.
Reduce wrist burns from sweat by using protective cream.

Eye Protection – ALWAYS wear shielded glasses and/or fitted goggles around product to reduce eye injury. Flush eyes immediately and seek medical attention. Contact lenses may impede first aid.

Other Protective Clothing – Wear long sleeve shirts and pants to minimize contact with product.

Source: Mississippi Lime MSDS for Calcium Oxide

Mississippi Lime
Quicklime and hydrated lime

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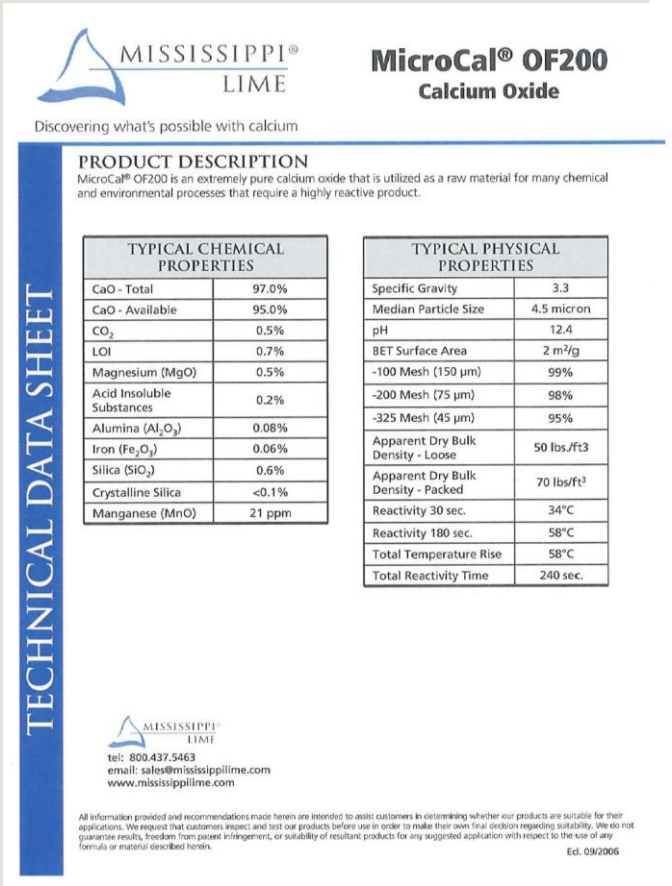

MISSISSIPPI® LIME

Discovering what's possible with calcium

MicroCal® OF200
Calcium Oxide

TECHNICAL DATA SHEET

PRODUCT DESCRIPTION

MicroCal® OF200 is an extremely pure calcium oxide that is utilized as a raw material for many chemical and environmental processes that require a highly reactive product.

TYPICAL CHEMICAL PROPERTIES	
CaO - Total	97.0%
CaO - Available	95.0%
CO_2	0.5%
LOI	0.7%
Magnesium (MgO)	0.5%
Acid Insoluble Substances	0.2%
Alumina (Al_2O_3)	0.08%
Iron (Fe_2O_3)	0.06%
Silica (SiO_2)	0.6%
Crystalline Silica	<0.1%
Manganese (MnO)	21 ppm

TYPICAL PHYSICAL PROPERTIES	
Specific Gravity	3.3
Median Particle Size	4.5 micron
pH	12.4
BET Surface Area	2 m^2/g
-100 Mesh (150 µm)	99%
-200 Mesh (75 µm)	98%
-325 Mesh (45 µm)	95%
Apparent Dry Bulk Density - Loose	50 lbs./ft3
Apparent Dry Bulk Density - Packed	70 lbs/ft^3
Reactivity 30 sec.	34°C
Reactivity 180 sec.	58°C
Total Temperature Rise	58°C
Total Reactivity Time	240 sec.

MISSISSIPPI LIME
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