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U.S Department of Agriculture

Agricultural Outlook Forum 2003

February 20 & 21, 2003

NEW MARKETABLE PRODUCTS FROM ANIMAL WASTE

POTENTIALS FOR ENERGY FROM ANIMAL MANURE DIGESTERS

Dennis D. Haubenschild
President
Haubenschild Farm, Inc.

Agricultural Outlook Forum 2003

Haubenschild Farm

Producing many deliverables in an environmentally safe manner

Haubenschild Farm History

- Established 1952
- Started w/ 128 acres
- 100 year old house and farm buildings
- No electricity
- 2 cows
- $6,000

- 1990s became a 3 Generation Family operation
- 1000 acres
- Modern facilities
- 825 cows
- producing 53,000 + lbs of milk each day

PRINCETON

Farm Objectives

environment-friendly farm management

- Milk production
- Electricity production
- Heat recovery
- Minimized odors
- Soil preservation
- Effective feed program

- Recycled newspaper
- Recycled water
- Improved nutrients
- Family-oriented
- Fair profit
- Fun

Milk Production-Today

- 850 cows in production
- 100 in dry lot
- milking 3X per day
- ✪59,500 pounds per day or 7000 gallons

Milk Production

- no human handling
- closed sterile system
- minimal agitation

3F to 36F instantly

2 - 6,000 gallon tankers

Feed Management

- Computer generated TMR
- Minimal shrinkage

- Once a day feeding
- Recovery of unused portion
- Cost effective program

Manure Digester

30'LX30'WX14'D
/2 million gallons
0,000 gallons each day
onstant 100F degrees
,800' of piping

- Methane production via anaerobic decay

72500 cf of biogas per day

51 cf/min

23 cf/kWh

Methane Facts

- Naturally occurring gas
- Produced by many sources

(swamps, rice cultivation,animal husbandry, waste management)

- Captured and used as a commodity
- The conversion of wastes into value-added products represents the positive solution to pollution problems that are often caused by the accumulation of underutilized byproducts.

Manure Digester

- Capturing methane
- Reduced odors after processing

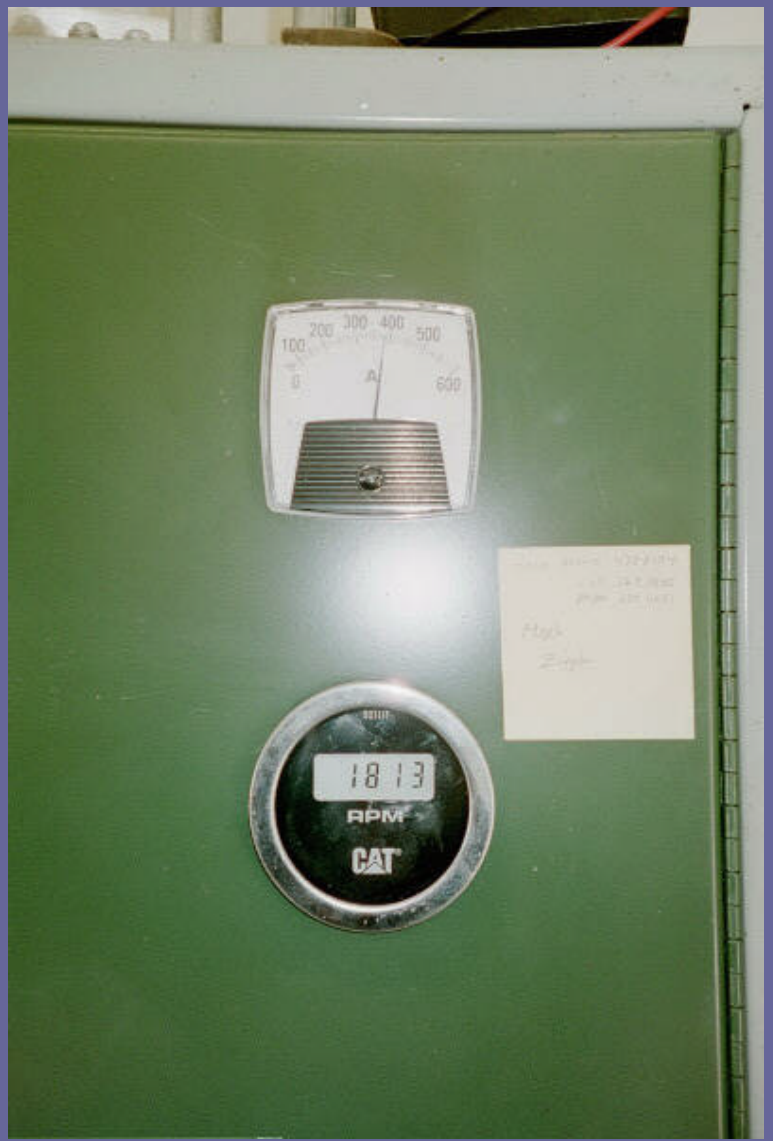
gas pipes

.5 million gallon lagoon

Methane Powered Co-gen Electricity Production

- Started project June 1999
- Fully operational Oct 1999
- 150Kw generator
- Waste heat recovery for digester operation and building heat

Methane Powered Co-gen Electricity Production



Electrical Transfer

connection to power company

Heat Recovery

heat exhaust recovery

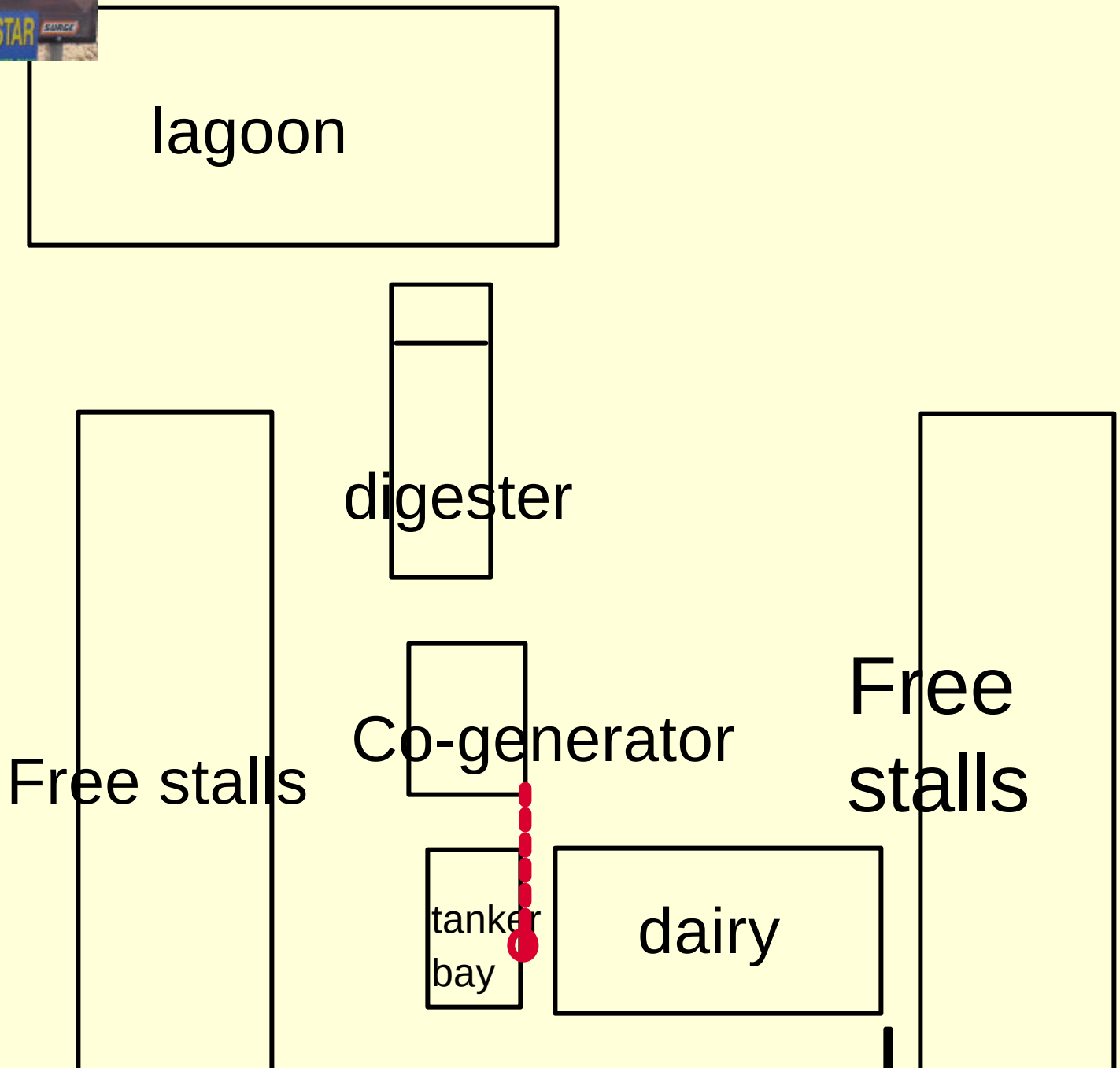
hot water storage - 180F

heat exchanger

boiler & pump

Layout

AgSTAR
SURGE
SURGE


lagoon
digester
Free stalls
Co-generator
Free stalls
tanker bay
dairy

Soil Preservation

- Increased nutrient value of the processed manure
- More readily available to crops

- estimated $40,000 savings in fertilizer
- manure is a commodity
- Digestate is a soil amendment

Recycled Water

- Reused many ways
- Milk cooling water goe to cow drinking water
- Milk equipment wash water goes for floor washing
- Floor wash water goes to digestor/lagoon

Recycled Newspaper for Cow Bedding

- 4 tons per week
- minimal costs

- Optimal bedding
- Excellent anaerobic

Table 1: Projected and Actual Costs of Haubenschild Farm Digester System

Component	Projected $	Actual $
Mix Tank/ Manure Collection		
Excavation/grading	3,400	0*
Cement work	12,500	18,800
Manure pump	10,000	11,300
Other (piping, installing)		2,300
Subtotal	***25,900***	***32,400***
Digester		
Excavation/grading	10,600	8,500
Digester tank	68,500	88,700
Heating	8,500	19,800
Cover	4,600	8,100
Start-up	5,000	0*
Miscellaneous	7,800	0*
Subtotal	***105,000***	***125,100***
Energy Conversion		
Building	17,400	16,400
Gas pipes	2,000	2,100
Gas pump/meter	6,000	2,000
Engine-generator/hot water recovery	87,000	106,000
Components and installation	13,700	31,000
Subtotal	***126,100***	***157,500***
Miscellaneous		
Engineering	25,000	40,000
Contingencies	25,700	0*
Subtotal	***50,700***	***40,000***
TOTAL	**307,700**	**355,000**
COST/COW (assuming 1000 cows)	**$307**	**$355**

*Costs for these items are embedded in other items for which costs are shown

01/11/2002	54949	505	20200	45749	10181	218	45	9170	11020	$811.16	$1,454.50	53372000	114200	480900	90	2.3	18951.8	167.2
01/18/2002	55403	454	18130	45962	10215	213	54	9060	9130	$673.52	$1,316.80	53829000	114280	457000	30	0.8	20120.9	165.1
01/25/2002	55803	400	16030	46178	10268	214	53	9050	6910	$514.49	$1,180.30	54229000	114300	399600	30	0.8	20289.9	148.0
02/01/2002	56388	585	23400	46401	10323	225	55	9550	13850	$1,018.15	$1,366.50	54705700	114275	477100	15	0.4	20448.3	178.4
02/08/2002	56674	286	11440	46597	10375	199	52	8360	5080	$236.66	$829.40	55107700	114290	402000	10	0.4	20603.1	154.0
02/15/2002	57134	460	18400	46811	10429	214	51	9100	9300	$688.02	$1,334.30	55577100	114320	489400	30	0.8	20773.6	170.5
02/22/2002	57631	497	19880	47029	10486	212	59	9070	10810	$798.77	$1,441.30	56063400	114330	486300	10	0.3	20942.5	169.9
03/01/2002	58146	515	20600	47230	10540	207	52	8800	11800	$869.76	$1,483.50	56546200	114430	492800	100	2.7	21109.3	168.8
03/08/2002	58509	463	18520	47439	10584	209	44	5760	9780	$713.82	$1,342.70	56987700	114480	421500	50	1.4	21254.3	145.0
03/15/2002	59158	649	21980	47647	10628	203	44	8800	13160	$965.82	$1,582.10	57470900	114540	508100	180	4.4	21428.5	174.2
03/22/2002	59694	536	21440	47849	10679	201	51	8560	12860	$947.63	$1,564.40	57953100	114640	477300	200	5.5	21591.2	162.7
03/29/2002	60218	524	20960	48050	10731	202	52	8800	12380	$909.56	$1,519.80	58438400	115050	485300	260	6.8	21757.9	166.7
04/05/2002	60739	521	20840	48247	10800	197	55	8570	12270	$907.17	$1,510.90	58930700	115260	492300	170	4.6	21926.7	169.0
04/12/2002	61254	515	20600	48448	10857	199	57	8530	12070	$888.61	$1,485.50	59417600	115420	486900	160	4.4	22093.8	168.9
04/19/2002	61778	524	20960	48648	10902	223	45	9370	11550	$851.75	$1,519.90	59936300	115710	500700	280	7.8	22263	169.4
04/26/2002	62303	525	21000	48847	10964	199	62	8540	12460	$919.16	$1,522.50	60435800	118110	487600	400	10.8	22428.4	165.4
05/03/2002	62776	473	18920	49048	11019	201	55	8590	10330	$762.95	$1,371.70	60873300	118230	488000	120	3.3	22595.4	167.0
05/10/2002	63248	472	18880	49304	11084	236	36	10090	8790	$653.65	$1,368.80	61412300	118320	538700	90	2.5	22790.3	194.9
05/17/2002	63743	495	19800	49492	11145	189	51	8130	11670	$861.63	$1,435.50	61923900	118470	411300	150	4.1	22932.4	142.1
05/24/2002	64276	532	21280	49702	11201	213	56	8560	12320	$907.48	$1,542.30	62321900	118530	457900	180	4.4	23103.2	169.8
05/31/2002	64771	495	19840	49965	11254	267	53	11210	8630	$639.19	$1,438.40	62802800	118800	490600	170	4.8	23287.8	185.6
06/07/2002	65266	495	19820	50238	11304	267	50	11180	8340	$617.40	$1,415.20	63285200	118980	482600	180	4.9	23435.1	167.3
06/14/2002	65719	453	18400	50531	11358	295	54	12340	6050	$403.12	$1,334.30	63763800	117080	478400	100	2.7	23602.4	167.3
06/21/2002	66230	511	20440	50836	11403	304	46	12810	7630	$579.15	$1,481.90	64283700	117190	500100	110	3.0	23772.4	170.0
06/28/2002	66723	493	19720	51148	11451	313	48	13000	6720	$499.44	$1,429.70	64755500	117250	491800	100	2.7	23940.9	169.0
07/05/2002	67155	432	18040	51451	11492	313	61	12830	6110	$453.43	$1,380.40	65254800	117470	496500	180	4.9	24108.3	167.4
07/12/2002	67573	418	16980	51776	11536	313	44	13160	5800	$431.72	$1,374.90	65727700	118250	482900	780	21.3	24275.6	162.3
07/19/2002	68187	614	20960	52101	11576	322	40	13280	7680	$567.00	$1,519.90	66231100	119920	493400	1670	42.9	24437.8	167.2
07/26/2002	68726	539	21160	52421	11622	320	46	13260	7900	$584.46	$1,534.10	66726200	121260	495100	1440	39.3	24605.1	168.3
08/01/2002	69254	528	21120	52748	11658	327	36	13440	7680	$565.98	$1,521.20	67226500	121570	502300	310	8.5	24775.1	169.0
08/08/2002	69741	487	19480	53062	11712	314	54	13100	6380	$476.32	$1,412.30	67700200	121880	471700	320	8.7	24942	166.9
08/15/2002	70266	614	20560	53394	11750	322	38	13260	7300	$538.64	$1,480.80	68187500	122230	487300	340	9.3	25111.7	169.7
08/23/2002	70756	501	20040	53698	11787	315	47	13370	6970	$517.31	$1,452.90	68673600	122500	476100	270	7.4	25278.2	166.5
08/30/2002	71283	527	21080	54018	11839	319	42	13180	7900	$583.46	$1,526.30	69189100	122820	495500	420	11.5	25445.9	167.7
09/06/2002	71808	525	21000	54332	11886	314	47	13050	7970	$589.81	$1,522.50	69686400	123500	497300	680	18.6	25615.2	169.3
09/13/2002	72316	508	20320	54643	11920	311	34	12780	7540	$555.32	$1,473.20	70152300	124070	465900	470	12.8	25780.1	164.9
09/20/2002	72840	524	20960	54936	11971	292	51	12190	8770	$648.83	$1,519.80	70650800	124250	488500	180	4.4	25948.9	168.8
09/27/2002	73369	529	21160	55180	12020	245	49	10250	10870	$800.67	$1,524.10	71144900	124500	494000	270	7.4	26117.6	168.7
10/04/2002	73880	511	20440	55444	12061	264	41	10870	9470	$697.03	$1,481.90	71635200	124590	488400	90	2.5	26284.3	166.7
10/11/2002	74393	513	20520	55674	12102	233	41	9810	10910	$801.43	$1,487.70	72120000	124700	491800	110	3.0	26453.4	169.1
10/18/2002	74906	513	20520	55899	12140	225	43	9430	11080	$814.99	$1,487.70	72611800	124800	486600	100	2.7	26621.1	167.7
10/25/2002	75397	491	19640	56122	12187	223	42	9340	10300	$757.48	$1,433.90	73082200	125150	480600	330	9.0	26789.8	168.7
11/01/2002	75929	532	21280	56349	12230	227	43	9510	11770	$864.29	$1,542.90	73581300	125190	499100	80	1.6	26958.6	168.0
11/08/2002	76427	498	20320	56572	12267	223	27	9190	11130	$813.81	$1,473.20	74065500	125215	484200	25	0.7	27126.5	167.7
11/15/2002	76900	473	18520	56787	12312	225	55	9550	8970	$664.35	$1,342.70	74549400	125250	483900	35	1.0	27294.4	167.9
11/22/2002	77461	561	22040	80	12367	225	45	9460	12580	$924.25	$1,567.90	75036800	125280	487400	30	0.8	27463.1	168.7
11/29/2002	77960	499	20380	272	12411	192	54	8220	12140	$893.92	$1,476.10	75517800	125300	480800	20	0.5	27630.1	167.0
12/06/2002	78469	509	20360	496	12468	224	57	9530	10920	$799.71	$1,476.10	75987300	125310	479700	10	0.3	27797.6	167.5
12/13/2002	78922	453	18120	720	12516	224	48	9440	8880	$641.54	$1,313.70	76450000	125360	452700	50	1.4	27964.1	166.5
12/20/2002	79436	514	20560	949	12562	229	36	9520	11040	$809.68	$1,480.80	76930000	125415	490000	55	1.6	28129.6	156.5
12/27/2002	79918	482	19280	1171	12597	222	45	9330	9950	$732.85	$1,357.80	77406200	125510	478200	155	5.2	28292.1	162.5
01/03/2003	80395	477	19080	1384	12648	223	49	9410	9870	$713.57	$1,383.30	77884700	125730	476500	120	3.3	28450.1	158.0
01/10/2003	80879	484	19360	1615	12694	219	48	9240	10120	$745.94	$1,403.30	78365900	128100	481200	370	10.1	28626.2	168.1
01/17/2003	81340	461	18440	1848	12735	235	41	8810	8830	$638.13	$1,336.90	78831700	125380	465800	280	7.7	28796.4	170.2
01/24/2003	81764	414	16560	2083	12772	230	37	8770	6760	$501.71	$1,200.30	79272000	128420	440300	40	1.1	28968.2	166.8
01/31/2003	82216	452	18080	2313	12809	230	37	8670	8310	$655.41	$1,339.80	79722400	128710	450400	2250	62.6	29131.8	165.6
Total kWh made			3,335,480		Total kWh sold			1,694,960		$116,696.46	$241,822.30			79722400	128710	3517		166.3

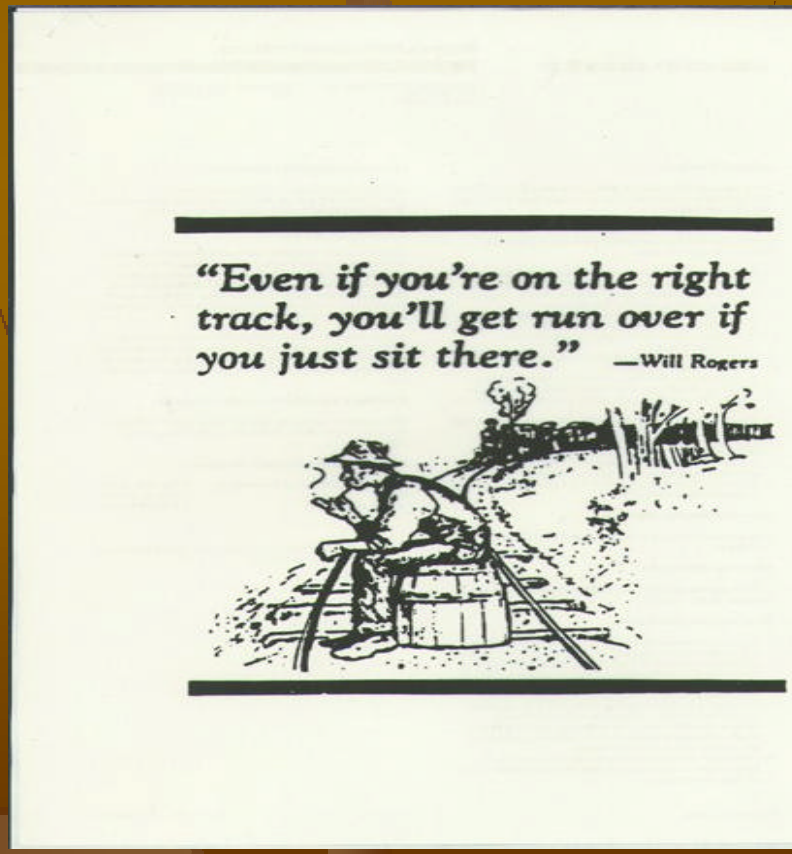
Advantages

- ✓ Reduce Odor
- ✓ Generation of Electricity
- ✓ Thermal Energy Production
- ✓ Increase in Fertilizer Value
- ✓ Pathogen Reduction
- ✓ Weed Seed Reduction
- ✓ Greenhouse Gas Reduction - Carbon Credit Value

SUMMARY

"Even if you are on the right track,

you will get run over

if you just sit there... "

Will Rogers