

Jan C Gawthrop, D.V.M., P.C.
11937 N. State Road 13
North Manchester IN 46962
260-982-7596
jan@calfcarevet.com

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Protocol Outline to Study the Effect of Adding Carbon to Calf Milk Replacer Diets on Diarrhea Disease, Overall Health and Weight Gain Performance

40 heifers purchased for Eastern order buyer to arrive the week of December 2, 2019

All with pre-existing conditions on arrival will be excused from the study.

All will be weighed on arrival. Skin notch will be tested for BVD-PI. Blood will be drawn to determine serum total protein.

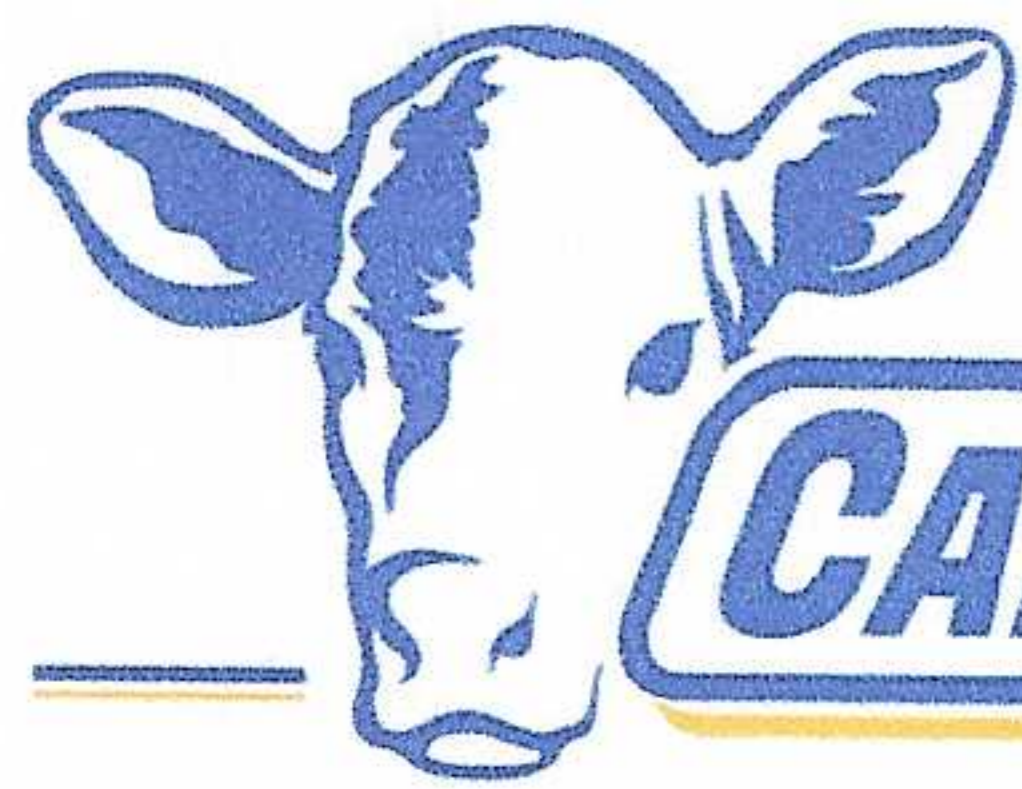
Half of the population will receive 2 grams of carbon in their milk replacer for 21 days. Half the population will receive the same ration without the added carbon.

Caretakers will record all illness in all the calves. Sick calves will be treated with the farm standard treatment protocol.

All calves that die will be necropsied to determine a cause of death.

All calves will be weighed at 6 weeks.

A final report will be generated to compare the health and performance of the two groups. This report will show effect of the product on number of calves with diarrhea and the duration and severity of the disease. The report will show the amount of overall sickness. The report will show weight gained in one group compared to the other.



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11937 North State Road 13, North Manchester, IN 46962 (260) 982-7596

Dr. Jan Gawthrop

Dr. Christy McKaig

Dr. Anne Budzinski

Dr. Kevin Funk

CalfCare 2019 – Carbon 01

48 Holstein calves were received, weighed and examined for inclusion into study at a private contract research facility in North-Central Indiana. Calves were purchased from a reputable calf-order-buyer and trucked in on December 3rd and 4th, 2019 for study to commence on December 5th. All calves were ear notched on arrival and determined to be BVD Negative by ELISA test. One calf from each shipment was excluded based on preliminary physical examination, leaving 46 to be equally divided into two groups of 23 for treatment and control. Calves were assigned to their respective group based on average weight. Calves were managed in the same manner, with the only exception being the addition of carbon at 2 grams per head per feeding for the first 21 days. After 21 days, the additional carbon was removed from the milk replacer feedings and all calves were fed in identical manner until weaning. CalfCare staff recorded daily observations and individual calf treatments from Day 1 until calves were weaned at day 42, weighed again and assigned into group pens for post-weaning analysis.

Average weights (in pounds) in and weights out, weight gains, average daily gain (ADG) and total individual treatment costs are summarized in the table below.

Carbon

Avg. In	Avg. Out	Avg. Gain	Avg. ADG	Total Tx \$\$
96.26	160.9	64.7	1.539	\$ 145.99
0.1% ++	3.4 % ++	8.9 % ++	8.8 % ++	\$6.35 / Head

Non-Carbon

Avg. In	Avg. Out	Avg. Gain	Avg. ADG	Total Tx \$\$
96.17	155.6	59.4	1.414	\$ 205.02
				\$8.91 / Head

Further analysis of the top 30%, the top 70%, and the bottom 30% in gains from each treatment group saw similar trends of increased gains and lower treatment costs in the group that ingested carbon versus the control group. The top 30 % in gains (8 animals from each treatment group) were found to be 1.3 % higher in ADG (1.821 versus 1.798) and treatment costs were lower by more than 50 % (\$4.20 / head versus (\$8.84 / head). Results from the top 70 % again favored carbon with 1.643 ADG versus 1.613 and treatment cost of \$5.60 / head opposed to \$6.25 / head. The worst performers in term of gains from each group were analyzed (7 from each group) which yielded 35.9% increased ADG (1.303 versus 0.959) and \$8.06 / head treatment cost over \$15.01 / head – again favoring addition of carbon to the milk replacer. Four calves failed to achieve 1.000 on average daily gain, all of which were in the non-carbon group.



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When examining the ten most expensive calves in terms of individual treatment cost, we see that Non-carbon calves were 4.3% heavier on entry (Average 96.0 lbs. versus 92.0 lbs.).

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These 10 calves were also \$6.03 / head more expensive to treat than their carbon fed counterparts. However, when these two subsets were weighed out on Day 42, the calves from the carbon-fed group gained an average of 5.3 lbs. (9.5 %) more and had a higher ADG than the control group as shown in the table below:

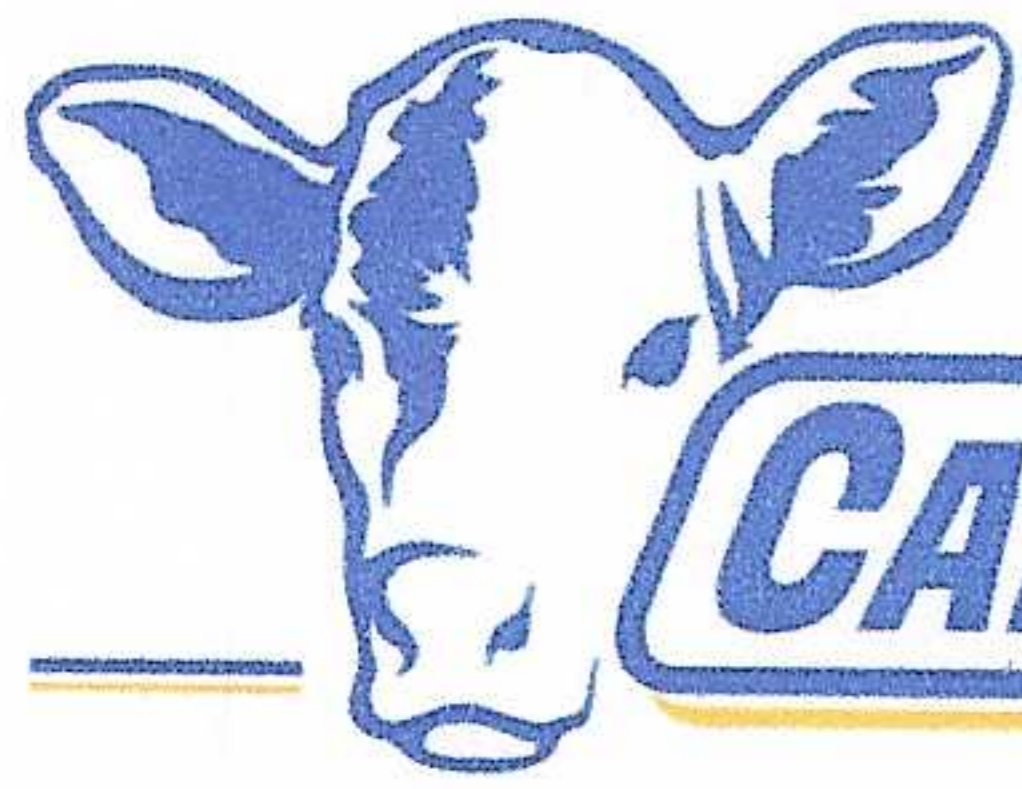
	Avg. IN	Avg. Out	Avg. Gain	Avg. ADG	Tx Cost
bottom 43%	92.0	152.9	60.9	1.450	\$ 131.96
Carbon		0.9 % ++	9.5 % ++	9.5 % ++	10 of 10 treated (100%) \$13.20/head

	Avg. IN	Avg. Out	Avg. Gain	Avg. ADG	Tx Cost
bottom 43%	96.0	151.6	55.6	1.324	\$ 192.33
Non-Carbon	4.3 % ++				10 of 10 treated (100%) \$19.23/head

Both groups had representatives in terms of calf diarrhea. In looking at the number of calves from each group that scored for diarrhea, we see very little difference – Carbon fed calves had 8 head scored and the control group had 9. Examination of daily observation records shows that all calves that scored for diarrhea, scored between Day 0 and Day 12 as is common in any commercial calf raising operation. Looking a duration of scours – as defined by consecutive days scored for diarrhea – we see little difference between the groups. The average duration of scours for the carbon fed group was 1.25 days while the control group 1.46 days. Economic assessment of the calves that had associated fecal scores showed little difference with an average treatment cost of \$10.12 / head in the control group and \$10.58 / head in the treatment group.

Where we begin to see a difference between the groups is in examination of the severity/frequency of diarrhea and the Day 42 weights. Scoring for calf diarrhea was assigned a numerical value with '0' meaning the calf was passing normal feces. A score of '1' was a mild diarrhea with some degree of associated consistency. A score of '2' was the consistency of water and the highest on the scale. Of the 8 calves in the carbon treatment group, none were recorded with a score of '2'. Conversely, the control calves had 5 of their 9 representatives score with a value of '2' at least once, and some multiple times.

A tally of all fecal scores for the carbon fed calves gives us ten entries among 8 calves with a combined numeric fecal score of 10. The control calves had twenty-two entries shared between 9 calves with a cumulative score of 27. Clearly, this data set infers that frequency and severity of diarrhea were reduced in the treatment group.



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In the calves that scored for diarrhea, the average IN weight was 6.7 pounds greater in the control calves (90.7 lbs. versus 84.0 lbs.). Remarkably, the carbon fed calves made great strides on gains by Day 42 over the once heavier control calves – posting 20.5 % more average gain.

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Control calves having scored for diarrhea finished on Day 42 with an average gain of 48.7 lbs. (Three of the four calves that failed to attain an ADG of 1.000 were in this group). Those in the carbon fed treatment group were 2.4 % (3 lbs.) heavier and finished with average gain of 58.6 lbs. This may be due to less observed frequency and severity of diarrhea in the calves fed carbon.

Troy McElveen

Laboratory and Research Director

CalfCare



Office: 1-260-982-7596

Cell: 1-574-549-2581

Fax: 1-260-982-6056

Home: 1-260-330-3613

Email: troy@calfcarevet.com