IMPROVING STRAW QUALITY WITH ANHYDROUS AMMONIA

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According to the 1980 issue of North Dakota Agricultural Statistics, North Dakota farmers harvested more than twelve million acres of small grain. According to the same source, there were approximately two million head of cattle on North Dakota farms on January 1980. Figuring a conservative yield of one third ton of straw per harvested acre, livestock producers have a potential feed source of approximately two tons per head. Cereal straws in their natural state have low protein levels and poor digestibility which limits their use in rations for cattle to some percentage of rations, usually less than fifty percent. Straw digestibility and intake by cattle can be improved by treatment with Sodium Hydroxide (NaOH) or Anhydrous Ammonia (NH_3). Research by Hugh Nicholson at the University of Saskatchewan indicated an improvement of from 4% crude protein for untreated straw to 10-12% for straw treated with 3.5% Anhydrous Ammonia. He also reports 45 to 48% for treated straw. This level of crude protein and T.D.N. is about equal to most medium quality hays. This improvement in straw quality could be worth many dollars to North Dakota grain and livestock producers.

In the fall of 1979, a trial was designed to evaluate the treatment of wheat straw with 3.5% Anhydrous Ammonia. Steer calves fed a backgrounding ration were used to evaluate treatment effects. The trial has continued in 1980 and 1981, thus providing three years replicated results.

In all three years, large bales of wheat straw were hauled to the experiment station feedlot. A moisture sample was taken and bale weights were adjusted to a dry matter basis of approximately 675 to 700 pounds per bale. The bales were then lined up side by side on a sheet (28x100′) of 4 ml black plastic, which was then wrapped over the bales and sealed to make an air tight package (16 bales). Used rubber tires were piled on top and along the sides of the stack to reduce wind damage. An Anhydrous Ammonia nurse tank from the local Farmers Union Oil Co. was flow calibrated under water prior to injection of the Anhydrous Ammonia. Injection of approximately 3.5% dry matter weight was made into the core of each bale using a four foot long perforated metal pipe (1″OD) that was sealed and brought to a point on one end. The other end of the pipe was fitted with an adaptor that allowed the injection pipe to be connected to the nurse tank delivery hose. Extreme care and safety precautions were exercised while handling the Anhydrous Ammonia.

In 1979, the 94% dry matter straw was treated on September 24th; and in 1980 the straw contained 88% dry matter and was treated on September 24th; in 1981 the straw contained 86% dry matter and was treated on October 5th. The straw remained covered from 55 to 60 days, after which the plastic was removed and bales were processed through a New Holland Tub Grinder. The cost of the plastic cover plus the 3.5% anhydrous treatment increased the cost of the straw to $15.50 per ton in 1979 and $20.04 per ton in 1980 and 1981. This does not include any cost for labor to handle and treat the straw.

In late November, 36 head of 450-550 pound steer calves were allotted to six uniform lots of six head per lot. Two lots were self fed a complete mixed ration of oats, mixed hay and minerals. Two lots were self fed a mixed ration that contained 30% Anhydrous Ammonia treated straw while another two lots received a complete mixed ration containing 30% untreated wheat straw and served as the control. The rations were formulated with the aid of AGNET to promote gains of 1.5 to 2.0 pounds per head per day.

The steers on trial were weighed every twenty eight days and were sold at backgrounded weights of 750-800 pounds at a local auction market in treatment groups.

Table 1 shows the 1982 results of feeding the ammoniated straw.

Table 2 shows the 3-year results of feeding ammoniated straw.

Discussion:

The treatment of wheat straw with 3.5% NH_3 was not a difficult task, although care must be exercised whenever NH_3 is handled. We found a better response to the treatment as level of moisture in the straw increased. Calves fed the treated straw in 1982 consumed about one pound of straw more than calves fed untreated straw. They were the heaviest of all calves marketed and sold for the most gross dollars. However, because of high consumption they incurred a higher feed bill which lowered return per calf. Perhaps a more efficient and cost effective method of treating the large bales of straw would help reduce the cost of the feed. For example, a producer with adequate straw that could be fed for just the cost of baling and handling and with the ability to lower his cost of his plastic covering by using it more than one year would be very competitive with the producer feeding hay.

Over the three years, the NH_3 treated straw ration promoted faster daily gains, heavier market weights and higher market values than the control rations with untreated straw. However, due to higher feed cost per head, returns per calf fed the treated straw were only slightly better than those realized when regular straw was used in the ration.

Summary:

Results from three years feeding show that wheat straw treated with 3.5% Anhydrous Ammonia (NH_3) increased intake, improved average daily gain and increased the market value of calves when compared to feeding untreated straw. However, the extra cost incurred due to treatment (NH_3 and plastic covering) reduced returns per calf to less than one dollar per calf over feeding regular straw. The best gains were made by calves fed a mixed hay grain ration.

Table 1. Results from the Feeding Trial with Ammoniated Straw – 1982

	30% Untreated Straw		30% Ammoniated Straw		All Hay – Control	
	Lot 2	**Lot 4**	**Lot 3**	**Lot 5**	**Lot 6**	**Lot 7**
No. Head	6	6	6	6	6	6
Final Wt, lbs.	708	709	715	769	733	736
Initial Wt, lbs.	504	505	506	506	506	499
Gain/lbs.	204	204	209	263	227	237
Days Fed	127	127	127	127	127	127
ADG/lbs.	1.60	1.61	1.65	2.07	1.79	1.86
Actual Market Wt, lbs.	687	687	715	715	709	709
Avg. Market value, $	444.89	444.89	465.02	465.02	460.96	460.96
Percent Shrink	3.0	3.0	3.65	3.48	3.5	3.5
Feed/hd./day, lbs.:						
Barley	2.1	2.1	2.3	2.4	1.1	1.0
Oats	5.1	4.9	5.4	5.9	6.3	6.1
Mixed Hay	6.1	6.1	6.5	7.1	12.3	12.0
Straw	5.9	5.8	6.3	6.9	-	-
Di-cal	.12	.10	.12	.14	.16	.15
Limestone	.03	.04	.03	.04	.01	.01
Salt	.38	.37	.40	.44	.40	.39
Total lbs/hd./day	19.73	19.41	21.05	22.92	20.27	19.65
Feed cost/hd., $	120.20	117.74	136.33	148.37	132.09	127.88
Return/calf, $	324.69	327.15	328.69	316.65	328.87	333.08
Avg. Feed/Cwt Gain, $	59.12	57.66	65.17	56.33	58.10	54.00

Table 2. Three Year Combined Results from the Feeding Trial With Ammonia Treated Straw

	30% Un-treated Straw	30% Ammoni-ated Straw	Control All Hay
No. Head	36	36	36
Final Wt, lbs.	753.7	779.2	809.7
Initial Wt, lbs.	506.7	506.8	505.8
Gain/lbs.	247.0	272.3	303.8
Days Fed	141	141	141
ADG/lbs.	1.75	1.92	2.13
Actual Market Wt, lbs.	735.3	750.8	779.8
Avg. Market Value, $	453.70	469.83	484.25
Percent Shrink	2.45	3.60	3.70
Feed/hd./day, lbs:			
Barley	3.17	3.17	0.35
Oats	3.53	3.77	6.80
Alfalfa	2.98	2.90	3.41
Mixed Hay	3.89	4.11	9.63
Straw	5.78	5.82	-
Di-cal	.04	.06	.12
Limestone	.02	.02	.07
Salt	.20	.22	.41
Total lbs/hd./day	19.62	20.08	20.79
Feed Cost/hd., $	106.91	117.21	123.17
Return/Calf, $	346.79	347.62	361.08
Avg. Feed/Cwt Gain, $	44.84	44.44	42.13