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ALFALFA LEAF MEAL IN BEEF STEER RECEIVING DIETS

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Summary

Two trials were conducted to study the effects of alfalfa leaf meal (ALM) in receiving diets of steers. In trial one, ninety-six medium frame, Angus and Angus cross steer calves (average initial weight 500 lb) were allotted to a heavy or light weight block and then randomly assigned to one of four dietary treatments for a 29-day receiving trial. In trial two, sixty medium frame, Angus and Angus cross steer calves (average initial weight 518 lb) were allotted to one of ten dietary treatments. Trial two was divided into two periods, defined as a receiving period, 29 days, and a step-up period, 33 days. In trial one, treatments were control (supplemental soybean meal), alfalfa leaf meal (ALM) providing 33%, 66%, or 100% of supplemental protein; the balance was soybean meal. Receiving diets were formulated to contain .54 Mcal NE_g /lb dry matter, 14% crude protein, .6 % Ca and .3 % P. In study two, treatments were control (supplemental soybean meal), ALM providing 33%, 66%, 100% of supplemental protein, the balance was soybean meal and urea or a blend of ALM and blood meal (93 % ALM and 7 % blood meal) to provide supplemental protein. Each protein treatment was fed in diets consisting of cracked or whole corn. Trial two receiving diets were formulated to contain .54 Mcal NE_g /lb dry matter, 14% crude protein, .6 % Ca and .3 % P, step-up diets were formulated to contain .58 Mcal NE_g /lb dry matter, 11.3% crude protein, .6 % Ca and .3 % P. In trial 1, steers fed 100 % ALM and 66 % ALM diets consumed more ($P < .05$) total dry matter (DM) than steers fed soybean meal as the supplemental protein source. Steers fed 100 % ALM also consumed more DM ($P < .05$) than those fed 33% ALM and steers fed 66 % ALM tended ($P = .06$) to consume more dry matter than those fed 33% ALM. Although steers fed higher levels of ALM consumed more dry matter, steers fed soybean meal had higher ($P < .05$) average daily gains and therefore were more efficient ($P < .05$) requiring less DM/lb gain. In the receiving period of trial two, protein source did not affect ($P > .05$) performance. However, steers fed whole corn-based diets consumed more DM ($P < .05$) than those fed cracked corn. There were no other significant effects on performance due to corn processing. During the step-up period, there were no significant effects ($P > .05$) due to protein source or corn type.

Introduction

Alfalfa leaf meal is a byproduct of processing alfalfa hay to separate stems for power generation. The leaves are high in protein, calcium and other minerals. In addition, the energy content of leaves should approximate that of high quality hays or small grains silages. Because of its relatively high fiber content, ALM may affect rumen function positively in high forage diets. These characteristics make ALM an alternative and

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possibly beneficial feedstuff for use in diets of newly received feedlot steers. Therefore, the objectives of this study were twofold:

a) to determine the feeding value of ALM in whole or cracked corn diets of newly received feedlot steers, and
b) to determine whether ALM had any additive or beneficial effects on health and performance of newly received steer calves.

Materials and Methods

Two trials were conducted to study the effects of ALM in receiving diets of steers.

Trial 1, ninety-six medium frame, Angus and Angus cross steer calves (average initial weight 500 lb) were allotted to a heavy or light weight block and then randomly assigned to one of four dietary treatments for a 29-day receiving trial. Trial 1 was conducted at the University of Minnesota North West Experiment Station. Treatments were supplemental soybean meal; (ALM-00) and ALM providing 33% (ALM-33), 66% (ALM-66) or 100% (ALM-100) of supplemental protein; the balance was comprised of soybean meal. Diets were formulated to contain .54 Mcal NE_g /lb dry matter, 14% crude protein, .6 % Ca and .3 % P. Supplements were fed at the rate of 4 lb/head/day and formulated to provide supplemental CP, and balance vitamins and minerals. Nutrient analysis of feedstuffs and composition of supplements are provided in Table 1 and 2. Steers were vaccinated with Pasteurella multocida, haemolytica, hamophilus somnus, clostridium, IBR, BVD, and PI_3 and dewormed with ivermectin on day 1 of the trial. Data in trial 1 were analyzed for effects of supplemental protein source on average daily gain (ADG), DM intake, and DM required/lb gain as a randomized block design using pen as the experimental unit. Least square means procedures were used to separate mean differences when the effect was significant at $P < 05$. Orthogonal contrasts were used to test trends resulting from substituting soybean meal with ALM.

Table 1. Nutrient composition of feeds (Trial 1).

		DM basis, %		
Feeds	DM, %	CP	NDF	ADF
Corn silage	29.7	7.18	45.96	22.93
Cracked corn	93.6	8.86	9.07	1.19
Cracked barley	92.5	14.10	18.31	4.10
Supplements[a]				
ALM00	90.7	25.01	17.69	6.55
ALM33	93.0	24.98	21.63	10.55
ALM66	94.3	21.48	25.80	14.16
ALM100	95.0	21.04	30.42	18.19
Alfalfa leaf meal	96.8	22.88	32.73	19.20

[a] ALM00, ALM33, ALM66 or ALM100: Alfalfa leaf meal-based supplement with 0, 33, 66 or 100% of the supplemental protein derived from alfalfa leaf meal; the balance protein was derived from soybean meal.

Table 2. Composition of supplements[a,b] (Trial 1).

Ingredient	ALM00	ALM33	ALM66	ALM100
Grain mix[c]	46.69	34.14	20.49	5.72
Alfalfa leaf meal	0	25.53	50.15	81.18
Soybean meal	36.95	25.28	13.25	0
Molasses	7.08	7.08	7.08	7.08
$CaCo_3$	3.68	2.80	1.85	.85
Bovatec	3.13	3.13	3.13	3.13
TM salt	1.60	1.60	1.60	1.60
DYNA-K	.43	0	0	0
Vitamin premix	.43	.43	.43	.43
Zn sulfate	.03	.03	.03	.25
Mn sulfate	.01	.01	.01	.01

[a] Supplements were fed at the rate of 4 lb/head/day.

[b] ALM00, ALM33, ALM66 or ALM100: Alfalfa leaf meal-based supplement with 0, 33, 66 or 100% of the supplemental protein derived from alfalfa leaf meal; the balance protein was derived from soybean meal.

[c] A 75:25 mixture of barley and corn.

In trial 2, sixty medium frame, Angus and Angus cross steer calves (average initial weight 518 lb) were allotted to one of ten dietary treatments. Trial 2 was conducted and the Beef Research Facilities at the University of Minnesota, St. Paul Campus. Treatments were supplemental soybean meal; (ALM-00), ALM providing 33% (ALM-33), 66% (ALM-66) or 100% (ALM-100) of supplemental protein (the balance was soybean meal) and a blend of alfalfa leaf meal and blood meal (ALM-BLEND); (93 % ALM and 7 % blood meal) to provide supplemental protein. Each protein treatment in trial two was fed in diets consisting of either cracked or whole corn to form the ten treatments. Trial two was divided into two periods, defined as a receiving period, 29 days, and a step-up period, 33 days. Receiving diets were formulated to contain .54 Mcal NE_g /lb dry matter, 14% crude protein, .6 % Ca and .3 % P, step-up diets were formulated to contain .58 Mcal NE_g /lb dry matter, 11.3% crude protein, .6 % Ca and .3 % P. Supplements were fed at the rate of 4.5 and 3 lb/head/day for receiving and step-up periods, respectively, and formulated to provide supplemental CP, and balance vitamins and minerals. Nutrient analysis of feedstuffs and composition of supplements are provided in Table 3, 4 and 5 .

Table 3. Nutrient composition of feeds (Trial 2).

Feed	DM, %	DM basis, %		
		CP	NDF	ADF
PERIOD I				
Corn silage	39.99	7.43	48.00	23.11
Whole corn	91.82	9.78	9.30	1.41
Cracked corn	89.14	9.36	10.05	1.31
Supplements[a]				
ALM00	89.97	28.21	11.83	4.66
ALM33	92.43	27.83	17.25	8.52
ALM66	94.21	26.23	23.44	14.21
ALM100	96.44	25.62	30.59	19.77
ALMBLND	96.05	24.21	31.96	18.18
Alfalfa leaf meal	93.77	21.85	28.59	15.96
PERIOD II				
Corn silage	40.15	7.98	46.00	22.90
Whole corn	88.81	10.19	8.97	1.4
Cracked corn	87.60	9.87	8.64	1.26
Supplements[a]				
ALM00	91.75	26.95	11.59	5.25
ALM33	92.69	25.50	17.60	9.64
ALM66	94.03	24.68	22.39	13.71
ALM100	95.85	22.68	28.44	18.43
ALMBLND	95.03	23.24	29.97	17.47
Alfalfa leaf meal	93.77	21.85	28.59	15.96

[a] ALM00, ALM33, ALM66 or ALM100: Alfalfa leaf meal-based supplement with 0, 33, 66 or 100% of the supplemental protein derived from alfalfa leaf meal; the balance protein was derived mostly from soybean meal.

Table 4. Composition of supplements[a,b] (Trial 2, Receiving Period).

Ingredient	ALM00	ALM33	ALM66	ALM100	ALMBLND
Corn	51.07	37.34	22.47	5.52	6.59
Deccox-6%	.09	.09	.09	.09	.09
Alfalfa leaf meal	0	25.56	53.29	85.51	79.58
Molasses	5.04	5.04	5.04	5.04	5.04
Bovatec-68	.09	.09	.09	.09	.09
$CaCo_3$	3.33	2.82	1.82	.36	.36
TM salt	1.51	1.51	1.51	1.51	1.51
Vit-A premix	.07	.07	.07	.07	.07
Zn sulfate	.07	.07	.07	.07	.07
Mn sulfate	.02	.02	.02	.02	.02
Cu sulfate	.01	.01	.01	.01	.01
DYNA-K	.38	0	0	0	0
Dicalcium phosphate	0	0	.02	.11	.11
Urea	1.31	1.38	1.44	1.53	.11
Vit-D premix	.07	.07	.07	.07	.06
Vit-E premix	.02	.02	.02	.02	.02
Soybean meal	37.00	25.93	13.98	0	0
Blood meal	0	0	0	0	6.29

[a] Supplements were fed at the rate of 3.5 lb/head/day.

[b] ALM00, ALM33, ALM66 or ALM100: Alfalfa leaf meal-based supplement with 0, 33, 66 or 100% of the supplemental protein derived from alfalfa leaf meal; the balance protein was derived mostly from soybean meal.

Table 5. Composition of supplements[a,b] (Trial 2, Step-up Period).

Ingredient	ALM00	ALM33	ALM66	ALM100	ALM BLND
Corn	39.32	27.75	14.91	.48	2.11
Alfalfa leaf meal	0	25.8	52.43	82.53	76.53
Soybean meal	37.67	25.6	13.53	0	5.57
Molasses	8.33	8.33	8.33	8.33	8.33
$CaCo_3$	7.43	6.43	5.50	4.17	4.17
TM salt	2.90	2.9	2.90	2.90	2.90
Urea	1.17	1.23	1.27	1.30	.10
CATTLYST-50	.07	.07	.07	.07	.07
Zn sulfate	.03	.03	.03	.03	.03
Mn sulfate	0	0	.01	.01	.01
Cu sulfate	0	0	0	0	0
DYNA-K	2.90	1.67	.83	0	0
Vit-A premix	.07	.07	.07	.07	.07
Vit-D premix	.10	.10	.10	.10	.10
Vit-E premix	.01	.01	.01	.01	.01

[a] Supplements were fed at the rate of 3 lb/head/day.

[b] ALM00, ALM33, ALM66 or ALM100: Alfalfa leaf meal-based supplement with 0, 33, 66 or 100% of the supplemental protein derived from alfalfa leaf meal; the balance protein was derived from soybean meal.

Steers were individually fed through Calan-Broadbent door feeding systems. Data from two steers were not included in the receiving period of the trial due to an error in allocation to feeding station. Steers were implanted on day 1 of the step-up period with Synovex-S and vaccinated with Pasteurella multocida, haemolytica, hamophilus somnus, clostridium, IBR, BVD, and PI_3 and dewormed with ivermectin on day 1 of the trial. Steers were adjusted to Calan doors for a two-week period, then on day 1 were shipped two hundred miles where they were unloaded at a commercial sales barn, allowed to rest for two hours and then returned to the research facility. This was done to simulate stress in newly received calves. Data in trial 2 were analyzed for effects of supplemental protein source or corn processing on average daily gain (ADG), DM intake, and DM required/lb gain as a randomized block design using steer as the experimental unit. Least square means procedures were used to separate mean differences when the effect was significant at $P < 05$. Orthogonal contrasts were used to test trends resulting from substituting soybean meal with ALM, (ALM BLEND excluded).

Results and Discussion

Data are presented (Table 6) for effects of supplemental protein source on ADG, DM intake, DM required/1 lb gain in Trial 1. Steers in the ALM-100 and ALM-66 treatments consumed more ($P < .05$) total dry matter (DM) than steers fed ALM-00 diets. Dry

matter intake increased linearly (P <.05) as the level of ALM fed increased. Steers fed ALM-100 also consumed more DM (P <.05) than those fed ALM-33 and steers fed ALM-66 tended (P =.06) to consume more dry matter than those fed ALM-33. Although steers fed ALM-100 and ALM-66 consumed more dry matter, steers fed ALM-00 had higher (P <.05) average daily gains and therefore were more efficient (P <.05) requiring less DM/lb gain. Daily gain followed a cubic relationship (P <.05) in response to ALM level. Also, DM required/lb gain increased linearly (P <.05) with increasing level of ALM in diet.

Data are presented in (Table 7) for effects of supplemental protein source and corn type on ADG, DM intake, DM required/lb gain in Trial 2. In the receiving period of trial two, there were no significant effects (P >.05) on performance due to protein source. However, steers fed the whole corn treatment consumed more DM (P <.05) than those fed cracked corn. There were no other significant effects on performance due to corn type. For the step-up period of trial 2 there were no significant effects (P >.05) due to protein source or corn processing.

Table 6. Performance of steers fed diets supplemented with alfalfa leaf meal during a 28-day receiving period (Trial 1).

	Alfalfa leaf meal, % supplemental protein[a]				
Item	ALM00	ALM33	ALM66	ALM100	SE
No. pens	2	2	2	2	
Initial BW, lb	500	502	500	500	2.29
Final BW, lb	554	541	523	541	9.31
ADG, lb	1.84[b]	1.36[c]	1.54[c]	1.40[c]	.06
DMI, lb/day					
Grain	4.05[b]	5.14[c]	6.33[d]	6.88[d]	.14
Corn silage	5.94[b]	5.31[c,d]	5.45[b,d]	5.18[c,d]	.12
Supplement	3.68	3.75	3.82	3.86	.09
Total	13.66[b]	14.20[b,d]	15.6[c,d]	15.92[c]	.34
DM/lb gain, lb	7.51[b]	10.55[c]	10.19[c]	11.38[c]	.36
Alfalfa leaf meal, lb/day	0	1.03	2.12	3.28	.04

[a] ALM00, ALM33, ALM66 or ALM100: Alfalfa leaf meal-based supplement with 0, 33, 66 or 100% of the supplemental protein derived from alfalfa leaf meal; the balance protein was derived mostly from soybean meal.

[b,c,d] Means differ (P < .05).

Table 7. Performance of steers fed whole or cracked corn diets supplemented with alfalfa leaf meal during a receiving and a step-up period (Trial 2).

	Alfalfa leaf meal[a], % of supplements						Corn		
Item	00	33	66	100	BLND	SE	Whole	Cracked	SE
PERIOD I (receiving)									
Alfalfa leaf meal, lb/day	0	.905	1.79	2.95	2.74	.06	3.5	3.46	.66
No. steers	12	11	11	12	12		28	30	
Initial BW, lb	523	531	520	508	510	13.85	522	514	8.69
Final BW, lb	603	622	620	606	608	15.75	615	608	9.91
ADG, lb	2.86	3.25	3.56	3.47	3.51	.22	3.30	3.35	.14
DMI, lb/day									
Corn	2.28[b]	3.31[c]	4.17[d]	5.83[e]	5.89[f]	.13	4.45[b]	4.15[c]	.81
Corn silage	9.05[b]	8.78[b]	7.43[c,d]	6.58[c]	6.63[c]	.27	7.95[b]	7.45[c]	.17
Supplement	3.15	3.27	3.16	3.32	3.30	.11	3.26	3.22	.66
Total	14.48	15.36	14.76	15.74	15.82	.41	15.65[b]	14.81[c]	.26
DM/lb gain, lb	5.30	4.96	4.49	4.72	4.61	.38	5.00	4.63	.24
PERIOD II (step-up)									
Alfalfa leaf meal, lb/day	0	.73	1.56	2.49	2.29	.07	2.96	2.98	.08
No. steers	12	12	12	12	12		30	30	
Initial BW, lb	616	614	607	612	600	16.37	609	610	10.35
Final BW, lb	789	780	774	764	773	20.76	776	775	13.13
ADG, lb	5.24	5.05	5.04	4.62	5.25	.22	5.06	5.02	.14
DMI, lb/day									
Corn	10.75	10.46	11.44	11.40	11.86	.50	11.53	10.84	.32
Corn silage	6.06	5.59	5.89	5.41	5.64	.28	5.82	5.62	.17
Supplement	2.66	2.63	2.80	2.90	2.84	.12	2.79	2.74	.08
Total	19.47	18.68	20.13	19.70	20.33	.84	20.13	19.19	.53
DM/lb gain, lb	3.77	3.76	4.1	4.34	3.93	.24	4.06	3.90	.15

[a] ALM00, ALM33, ALM66 or ALM100: Alfalfa leaf meal-based supplement with 0, 33, 66 or 100% of the supplemental protein derived from alfalfa leaf meal; the balance protein was derived mostly from soybean meal.
[b,c,d,e,f] Means differ ($P < .05$).