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A Comparison of Growth, Feed Efficiency and Carcass Characteristics of Kamphaengsaen Steers Fed Two TMR Fiber Sources During Two Different Feeding Period

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ABSTRACT

Eighteen 8-9 months old Kamphaengsaen beef steers were compared on finishing performance and some carcass data using 3×2 factorials in CRD experiment. The first factor was three feeding regimens where the concentrate + fresh paragrass was used as the control ration while the other two rations were hedge lucern TMR (H-TMR) and leuceana TMR (L-TMR). The legumes used in the TMR rations are for the fiber source. The second factor was two finishing days duration where 180 days and 365 days was examined. Results showed that the daily feed intake calculated as percentage of the body weight of the control group (2.17 %) was statistically higher than the H-TMR (2.10%) and the L-TMR (1.99%) groups. The shorter finishing period group consumed statistically more feeds at 2.21% and 1.96% for the 180 days and 365 days group, respectively. The ADG and FCR of the H-TMR group (1.17 kg/d and 6.03) and the L-TMR group (0.94 kg/d and 5.60) were statistically better than the control group (0.94 kg/d and 7.28), respectively. Results on finishing days duration showed that the ADG of the 180 days group (1.13 kg/d) was statistically higher than the 365 days group (1.00 kg/d). The FCR of the 180 days group (6.16) showed a better trend than the 365 days group (6.44) although not statistically different. Chilled carcass weight of the control group (217 kg) was statistically lighter than the H-TMR group (249.92 kg) and the L-TMR (250.58 kg) group. However, the dressing percentage data showed no statistically different among the three groups 59.90%, 59.80% and 61.25 % for the control, H-TMR and L-TMR, respectively. Dressing percentage of 180 days finishing (59.63%) was not statistically different to the 365 days group (61.13%).
Key words : steer, carcass, TMR

INTRODUCTION

Production of beef cattle in tropical developing countries is usually associated with poor live weight gain as a result of using low nutritive value tropical feeds; largely crop residues. However, in recent years feeding of beef cattle using a total mixed ration (TMR) has been widely introduced into Thailand.

Due to this promoting and being accepted, the forage plant *Leucaena leucocephala* (Leucaena) has emerged to be a valuable and important source of feed for farm animals in the country. This is an example of an unconventional feed resource that is now widely put in to practice as a potential feed throughout tropical and subtropical regions.

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Possibly the best example of the success concerning leucaena in Thailand in recent years was that, it has been shown to be very valuable in promoting TMR, with good performance in finishing as compared data as to grazed cattle and especially the feed efficiency shown from the data obtained by Chuaychuwang (1997).

It is important to pay special attention to the fact that a wide variety of legume trees can grow in the tropics and their protein-rich quality forage can be used to improve the production of ruminants consuming low quality grass. One of the most widely used legume is the hedge lucern (*Desmanthus virgatus*). The hedge lucern which was formerly known in the sub-family Mimosaceae, is a thornless long lived plant which may grow to 3.5 m in height (Typha *et al.*, 1993). Nutritionally, the leaves and young stems are all excellent source of protein and mineral. Leaf and stem material of hedge lucern contains 12-16 percent crude protein and is also an excellent source of fiber (94.24 g/kg DM) for the TMR ingredient.

Although the hedge lucern are used commonly as a feed source for livestock, very little information is available concerning their nutritive value in the TMR diet. Hedge lucern can be partially substituted for leucaena in finishing diets. However, the potential value of hedge lucern as a fiber source in TMR beef finishing diets compared to leucaena in the same study is not known.

The objective of this study was to provide further research into determining the feeding value of hedge lucern versus leucaena mixture in TMR for finishing diets by evaluating their affects on animal growth performance and carcass characteristics when offered to Kamphaengsaen steers.

MATERIALS AND METHODS

The experiment was conducted at the Buffalo and Beef Cattle Production Research and Development Center, Kasetsart University, Kamphaengsaen Campus, Nakhon Pathom, 90 km west of Bangkok.

The 3×2 factorial in completely randomized design (CRD) with 3 replications were used. The factors were feeding regimen and finishing period. Eighteen experiment animals were randomly assigned to six treatments with one steer each per pen (three steers per treatment). The experiment was carried out over 6 and 12 months. The steers were individually housed in (2.5 m + 6 m) × 2 pens with free to water. Before commencement of the experiments steers were allowed to adjusted to their experimental diets for 10 days. Treatment 1 steers were sequentially fed the following diets for a ratio of roughage to concentrate 90: 10 for a 4-day, 80: 20 for a 3-day, 60: 40 for a 3-day, and 50: 50 until the end of experiment, respectively. Treatments 2 and 3 were variations of treatment 1 where steers were offered the following diets for a ratio of roughage to H-TMR and L-TMR: 50: 50 for a 4-day, 30: 70 for a 3-day, 10: 90 for a 3-day, and 00: 100 until the end of experiment, respectively. Diets were formulated to meet or exceed nutrient requirements for optimum growth performance (NRC, 1984). Vaccination against FMD was carried out at two weeks post-weaning. Deworming of all steers were done immediately after individual confinement using Anthelmec. Steers were castrated and implanted with the Synovex.

Each experimental animal in a pen was hand fed offered weighted amounts of feed individually and the diets were given twice daily in equal meals at 08.00 am and 4.00 pm hrs. Total amount of feed offered 3.0, 2.7 and 2.5% of 100-200, 200-300 and more than 300 kg body weight per head per day, respectively. Ingredients and chemical composition of the experimental diets are presented in Tables 1-3.

Feed intake was measured daily throughout the experiment by weighing feed offered. Feed refusals were removed from the bunks, weighed, and recorded daily in all treatment prior to the morning feeding. Initial and final weights were weighed at the start and end of the experiment. A single measure of body weight was also recorded at every 15-day intervals throughout the experiment at 08.00 a.m. Feed efficiency was computed from total feed consumption per replicate and total again per replicate. A comparison of carcass characteristics from 3 groups of steers were conducted. Groups of steers on all treatments were slaughtered with beginning after 180 and 365 days on feed. Steers were slaughtered at the University abattoir. Hot carcass weight (HCW) was recorded prior to overnight chilling at 4°C for 48 hrs. Carcasses were dressed according to standard commercial procedures. Back fat thickness was determined by average reading at point $^3/_4$ of the Longissimus dorsi (LD) at the 13th rib cross section of the left side.

Table 1 Feed formula and some chemical analysis (DM basis) for 135-200 kg BW [1/].

Item ingredients (%)	Control	H-TMR	L-TMR
Cassava	40.78	24.00	24.00
Coconut meal	25.00	32.00	32.00
Cane molasses	8.00	8.00	8.00
Corn	15.00	10.00	10.00
Soybean meal	6.00	5.00	5.00
Hedge lucern	-	12.00	-
Leucaena	-	-	12.00
Solvent extracted palm kernel [2/]	-	5.00	5.00
Urea	2.00	-	-
Mineral [3/]	3.22		
Cobalmixed- TMR [4/]	4.00	4.00	
Total	100.00	100.00	100.00
Chemical composition (%)			
Dry matter	88.40	88.70	88.70
Crude protein	18.32	17.58	17.13
TDN [5/]	80.65	77.00	77.00
Crude fiber	5.99	9.80	7.80
Calcium	0.72	0.66	0.66
Phosphorus	0.56	0.42	0.42

[1/] Computer analysis

[2/] Solvent extracted palm: CP, 15.17%; Fat, 0.19%; Ash, 6.73% ; CF, 29.65%; Ca, 0.14%, P, 0.53%.

[3/] Minerals (3.22 kg) : Salt, 1 kg; DICaP, 1.8 kg; NH_4SO_4, 0.1 kg; Rumensin, 0.02 kg; Premixed, 0.3 kg.

[4/] Cobalmixed-TMR : trade name of premixed for TMR composed of Urea, NH_4SO_4, $CaCo_3$, DiCaP, KCL, NaCl, Zeolite, Monensin Sodium and trace minerals..

[5/] Total digestible nutrients

RESULTS AND DISCUSSION

1. Finishing Performance

Feed intake was expressed in terms of kg DM (%BW) per head per day. The interaction involving periods and treatment were not statistically significant. The control group consumed more feed than steers fed H-TMR and L-TMR ($p<0.05$). Steers fed H-TMR consumed more feed than steers fed L-TMR (Table 4). However, there was no statistically difference in DMI percent of the body weight between H-TMR and L-TMR.

All-concentrate rations have usually been compared to rations containing approximately 20% roughage (White *et al.*, 1969). Davis *et al.* (1963) found similar gain and concentrate intake on all concentrate and 20% rice straw rations than with all-concentrate. From the above discussion, it should be clearly seen that increased DMI in the control group compared to H-TMR and L-TMR in the

Table 2 Feed formula and some chemical analysis (DM basis) for 200-350 kg BW 1/.

Item ingredients (%)	Control	H-TMR	L-TMR
Cassava	37.78	30.00	30.00
Coconut meal	25.00	17.50	17.50
Cane molasses	8.00	8.00	8.00
Dry alcohol by-product	7.00	5.00	5.00
Solvent extracted palm kernel 2/	2.00	9.00	9.00
Corn meal	15.00	14.50	14.50
Hedge Lucern	-	12.00	-
Leucaena	-	-	12.00
Urea	2.00	-	-
Mineral 3/	3.22		
Cobalmixed-TMR 4/	4.00	4.00	
Total	100.00	100.00	100.00
Chemical composition (%)			
Computer analysis			
Dry matter	88.50	88.40	88.46
Crude protein	16.83	14.04	14.02
TDN 5/	78.87	78.28	78.28
Crude fiber	7.91	9.84	7.87
Calcium	0.89	0.80	0.80
Phosphorus	0.57	0.36	0.36

1/ Computer analysis
2/ Solvent extracted palm kernel: CP, 15.17%; Fat, 0.1%; Ash, 6.73%; CF, 29.65%; Ca, 0.14%; P, 0.53%.
3/ Minerals (3.22 kg) : Salt, 1 kg; DiCaP, 1.8 kg; NH_4SO_4, 0.1 kg; Premix, 0.3 kg; Rumensin, 0.02 kg.
4/ Cobalmixed-TMR : trade name of premixed for TMR composed of Urea, NH_4SO_4, $CaCo_3$, DiCaP, KCL, NaCl, Zeolite, Monensin Sodium and trace minerals.
5/ Total digestible nutrients

present study probably due mainly to the high roughage content (50 per cent) in the ration. Observations in the present study were consistent with results of previous research by Stock *et al.* (1990) who found that DM percent of the body weight was increased by the diet with high amount of roughage.

Better performance of steers fed H-TMR

Table 3 Feed formula and chemical analysis (DM basis) for 350-500 kg BW [1/].

Item ingredients (%)	Control	H-TMR	L-TMR
Cassava	39.58	36.00	36.00
Coconut meal	20.00	12.00	12.00
Cane molasses	8.00	8.00	8.00
Dry alcohol by-product	8.00	6.00	6.00
Solvent extracted palm kernel [2/]	8.00	6.00	6.00
Palm shell [3/]	6.00	6.00	6.00
Palm fiber [4/]	6.00	10.00	10.00
Hedge Lucern	-	12.00	-
Leucaena	-	-	12.00
Urea	2.00	-	-
Mineral [5/]	2.42		
Cobalmixed-TMR [6/]	4.00	4.00	
Total	100.00	100.00	100.00
Chemical composition (%)			
Computer analysis			
Dry matter	88.70	88.90	88.90
Crude protein	14.36	13.27	12.82
TDN [7/]	77.11	74.46	74.46
Crude fiber	11.50	15.17	14.06
Calcium	0.68	0.79	0.79
Phosphorus	0.50	0.38	0.36
Laboratory analysis			
ADF [6/]	12.56	15.18	14.86
NDF [7/]	31.63	28.71	26.57

1/ Computer analysis
2/ Solvent extracted palm kernel: CP, 15.17%; Fat, 0.19%; Ash, 6.73%; CF, 29.65%; Ca, 14%; P, 0.53%.
3/ Palm shell: CP, 10.49%; Fat, 15.27%; Ash, 6.75%; CF, 27.12%; Ca, 0.52%; P, 0.18%.
4/ Palm fiber: CP, 6.9%; Fat, 6.65%; Ash, 4.61%; CF,26.58%; Ca, 0.40%; P.0.21%.
5/ Minerals (2,42 kg) : Salt, 1 kg; Premix, 0.3 kg; DiCaP, 1 kg; NH_4SO_4, 0.1 kg; Rumensin, 0.02 kg.
6/ Cobalmixed-TMR : trade name of premixed for TMR composed of Urea, NH_4SO_4, $CaCo_3$, DiCaP, KCL, NaCl, Zeolite, Monensin Sodium and trace minerals.
7/ Total digestible nutrient

and L-TMR has been reported in a limited number studies. However, it is likely that DM percent of the body weight increased linearly in relation to the effect of palatability on intake, which is as important as digestibility (Corkum *et al.*, 1994). To be productive, feedlot animals need to eat diets in excess of their maintenance requirements. Numerous studies have observed that additional flavoring agents in the feed can increase the amount of DMI so flavoring agents are often incorporated in commercial produced TMR and starter rations (Waldren and VanDyk, 1971). There is very little information on the use of hedge lucern flavoring agents and their effects when supplemented to TMR. However, Virapun *et al.* (1993) reported that hedge lucern is more palatable and appropriate for feedlot diets.

Analyses of variance for growth and feed efficiency are presented in table 4. Throughout the entire experiment, dietary treatment gave a highly significant direct effect on rate of live weight gain. Growth rate of the control group were highly statistically significant as compared to steers fed H-TMR and those fed L-TMR (0.94 vs. 1.17 and 1.09 kg/d). Nevertheless, steers fed H-TMR grew faster (1.17 vs.1.09 kg/d) than steers offered L-TMR ($p>0.05$). Steers which consumed L-TMR converted DM to gain more efficiently (5.60 vs. 6.03 kg/d gain) than steers fed H-TMR ($p>0.05$). Covariance analysis of feed efficiency showed a statistically significant difference ($p<0.05$) between the control group compared to two dietary treatments L-TMR and H-TMR (7.27 vs. 6.03 and 5.60 kg), respectively.

Recent research efforts in feedlot nutrition have been directed toward reducing the amount of roughage required in high-concentrate diets as means of decreasing the higher cost associated with feeding roughage (Traxler *et al.*, 1995). The energy derived from roughage often is more expensive than that obtained from feed grains, therefore, usually it is included in feedlot diets in only small amounts (Bartle and Preston, 1991, 1992). The results in this study was consistent with those reported by Loeston (1991), which demonstrated that when roughage was excluded from feedlot diets, performance has been similar to that of cattle fed typical feedlot diet up to day 120, after which performance declined continually.

There is a lack of information regarding

Table 4 Effects of H-TMR and L-TMR on finishing performance [1/].

Item	Dietary treatment		
	Control	H-TMR	L-TMR
No. of steers	6	6	6
Initial wt., kg	149.33 ± 16.68	154.67 ± 16.25	167.17 ± 27.00
Final wt., kg [1/]	388.00 ± 19.00	448.50 ± 20.00	438.67 ± 39.00
DMI, kg	6.05 ± 0.26	6.37 ± 0.34	6.23 ± 0.48
DMI (%BW)	2.17^{a} ± 0.08	2.10^{b} ± 0.07	1.99^{b} ± 0.14
ADG, kg	0.94^{b} ± 0.05	1.17^{a} ± 0.08	1.09^{a} ± 0.09
FCR, kg [2/]	7.28^{b} ± 0.53	6.03^{a} ± 0.71	5.60^{a} ± 0.62

[1/] Adjusted by initial weight.

[2/] Feed to gain (kg of feed per kg of live weight gain).

[a, b] Means in the same row with different superscript are different (*$p<0.05$*).

whether low or high levels of roughage are necessary in high concentrate finishing rations. However, Traxler *et al.* (1995) stated that greater than 20% roughage in feedlot diets decreased growth rate. Cattle may be finished on all-concentrate diets; however, gains and feed efficiencies usually have been improved by including a small amount of roughage (Brandt *et al.,* 1987). This is in close agreement with the value of roughage utilized in feedlot diets reported previously (Davis *et al.*,1963) found similar gains on all-concentrate and 20% roughage rations. As would be expected, a higher percentage of roughage in the control group in the present work as observed to be stunted when compared to H-TMR and L-TMR. The present findings clearly demonstrated the fact and coincide with early work by Church (1991) that roughage in feedlot diet is essentially used to control digestive disturbances by making the diet less dense and not as a source of nutrient. These digestive disturbances include subacute acidosis, liver abscesses, and bloat. Therefore, Church (1991) suggested that roughage offered in a feedlot diet should not exceed 20%. Similar responses have been observed by Howard and Plasto (1993) who demonstrated that a good balance of ADG is obtained when a ration of approximately 80% concentrate is fed. On the other hand, the present investigation agree with previous work by Dufrasne *et al.* (1995) that roughage at a high percent was not always available to an improve performance due mainly to in sufficient quality and grass growth being related to climate and to rainfall. By contrast, TMR diet was achieved practically in feedlot steer so that the improved performance of the finishing steer have to be associated with both in terms of management, environment and diet availability and type.

Leucaena is commonly used in TMR ingredient for finishing beef cattle. However, the nutritive value of leucaena with TMR versus hedge lucern has never been compared in the same study. Therefore, these very little information available concerning their nutritive value as a in TMR ingredient. In accordance with the present experiment results, it was clearly illustrated that ADG of steers fed H-TMR was greater than L-TMR. This is evidence, although not unanimous, that growth superiority of steers offered H-TMR over those which consumed L-TMR in the present work is in close agreement with that observed by Chyravate *et al.* (1993) who examined performance and feed efficiency of sheep and beef cattle fed diets containing hedge lucern. They found that sheep and cattle grew more efficiently and intake per unit gain were significant when compared to those fed napier grass and rice straw. The present results, showing an improved rate as a consequence of mixing hedge lucern with TMR, are similar to those of Virapun *et al.* (1993) obtained in an experiment in which hedge lucern was more suitable and proper for feedlot diet substitutes for leucaena.

Growth rate steers in the first feeding period were highly statistical significant compared to the second feeding period (Table 5). Nevertheless, steers in the first feeding period converted DM to gain more efficiently than steers in the second feeding period ($p<0.05$). The present finding is in agreement to previous work (Zinn *et al.,* 1970 a) which found significant difference on average feedlot gain increased with increasing time on feed and declined gradually as cattle reached slaughter weight. As would be expected, the longer the animal remains in the lot to reach a specified gain in weight, the less economically efficient the system becomes. Thus, there is an incentive to feed out cattle quickly. On the other hand, longer feeding may go beyond the point of optimal conversion, and therefore weight gain per day and feed conversion efficiency must both kept in view as criteria of efficiency, as each tends to adversely affect the other. Furthermore, rate of growth and conversion of feed to body mass were unaffected by the length of feeding period. Thus, it appears that growth was approximately linear and similar composition throughout the feeding period.

Carcass characteristics

Carcass data of steers fed H-TMR and L-TMR are presented in Table 6. The effect of H-TMR and L-TMR on slaughter weight was statistically different (p<0.05) as compared to the control group (428.5 vs.417.83 and 371.33 kg), respectively . Additionally, diet H-TMR had only a marginal increase in slaughter weight (428.5 vs. 417.83 kg) than diet L-TMR. However, there was no statistically significant difference on slaughter weight of steers fed H-TMR and L-TMR.

Results on hot and chilled carcasses weight were no statistically different (p>0.05) between steers fed H-TMR and those fed L-TMR. Nevertheless, steers fed H-TMR and L-TMR were statistically different (p<0.05) compared with the

Table 5 Effect of feeding period on finishing performance [1/].

Item	Feeding period	
	6 months	12 months
No. of steers	9	9
Initial wt., kg	156.66 ± 13.93	157.44 ± 29.30
Final wt., kg	358.56 ± 13.65	491.56 ± 36.56
DMI, kg	5.84 [a] ± 0.70	6.59 [b] ± 0.44
DMI (%BW)	2.21 [a] ± 0.09	1.96 [b] ± 0.10
ADG, kg	1.13 [a] ± 0.08	1.00 [b] ± 0.07
FCR, kg [2/]	6.16 ± 0.66	6.44 ± 0.40

[1/] Mean ± S.E.
[2/] Feed to gain (kg of feed per kg of live weight gain).
[a,b] Means in the same row with different superscript are different (*p<0.05*).

Table 6 Effect of H-TMR and L-TMR on carcass characteristics.

Item	Dietary treatment		
	Control	H-TMR	L-TMR
No. of steers	6	6	6
Slaughter wt., kg	371.33 [b]	428.50 [a]	417.83 [a]
Hot carcass wt., kg	220.50 [b]	253.00 [a]	253.33 [a]
Chilled carcass wt., kg	217.00 [b]	249.92 [a]	250.58 [a]
Dressing %	59.90	59.80	61.25
Back fat thickness, cm	0.18 [b]	0.40 [a]	0.35 [a]

[a, b] Means in the same row with different superscript are different (*p<0.05*).

control group on hot and chilled carcasses weight. According to a statistical analysis of the carcass characteristics on steers fed H-TMR and those on a L-TMR based diet, there was no effect on dressing percentage.

Significant differences were detected in the control group as compared to the H-TMR and L-TMR based diets on carcass characteristics. In view of the present findings, substantiate earlier studies (Owens *et al.*, 1995), which explained that higher level of roughage finishing of beef was not recommended in the past due to lower carcass weight, dressing percent, decreased quality grade, yellow fat colour, and decreased flavour relative to concentrate-fed beef. In contrast, other studies (McCaughey and Cliper, 1996) generally found no differences in palatability attributes between roughage and concentrate finishing beef. The results in the present study and many past studies (Hedrick *et al.,* 1983) were found in regards to the fact that the amount of back fat thickness at slaughter between extremely level of roughage and H-TMR and L-TMR-fed beef. In these studies, the control group often had minimal amounts of back fat and were slaughtered at lower weight relative to H-TMR and L-TMR.

Smith (1990) stated that greater amounts of roughage finishing is not recommended in the beef industry due to low weight gain relative to the complete diet. An extensive study of the effect of roughage on carcass characteristics was not possible, however, there was little evidence that these roughage had any effect on carcass values compared with H-TMR and L-TMR. Therefore, further research is needed to evaluate the amount of roughage finishing and the effect of feeding time on beef quality. As long as carcasses meet market specifications, such as grade, fat depth, fat colour, then the dietary treatment described here will lead to meat of similar quality to that of the H-TMR fed beef.

There were no statistically significant differences between dietary treatments of H-TMR and L-TMR on carcass characteristics. The present work indicated that the values of H-TMR were not different compared to L-TMR dietary treatment on carcass evaluation, although statistical analysis clearly indicated that steers offered H-TMR tend to be larger at slaughter weight and hot and chilled carcasses weight than steers which consumed L-TMR. Consequently, the experimental findings are difficult to assess due mainly to the fact that no other published data have examined the effect of both hedge lucern and leucaena mixture with TMR

Table 7 Effect of feeding period on carcass characteristics.

Item	Feeding period	
	6 months	12 months
No. of steers	9	9
Slaughter wt., kg	340.11 ± 31.59	471.67 ± 30.60
Hot carcass wt., kg	200.11 [b] ± 20.32	284.44 [a] ± 17.45
Chilled carcass wt., kg	198.33 [b] ± 20.54	280.00 [a] ± 17.91
Dressing %	59.63 ± 1.42	61.13 ± 2.41
Back fat thickness, cm	0.26 [b] ± 0.15	0.36 [a] ± 0.10

[a,b] Means in the same row with different superscript are different ($p<0.05$).

on carcass characteristics. Thus, it is of great importance that these factors are accounted for further research concerning the effects of hedge lucern and luecaena nutritive values with TMR ingredient on carcass evaluation of Kamphaengsaen beef cattle.

Steers that were finished for 365 days had a higher value of back fat thickness than those finished 180 days ($p<0.05$) as shown on table 7. This is consistent with previous study Tatum *et al*., (1980) who stated that cattle fed longer (160 d) had higher ($p<0.05$) values for fat thickness, than carcasses from cattle fed for a shorte period (100 d). Other research indicated that as cattle are fed for longer period before slaughter, there were increase in marbling scores and quality grade (Campion *et al.,* 1975), and subcutaneous fat thickness (Campion *et al.,* 1975).

CONCLUSION AND RECOMMENDATIONS

It is concluded that under the conditions of the present experiments, offering steers H-TMR based diets can achieve advantage as it improves animal growth performance. These responses observed from steers offered H-TMR indicated that live weight gain seemed to be better than steers fed L-TMR. Steers fed 180 days had higher weight gain, and better FCR than steers fed 365 days. Since animal performance increased linearly for steers fed H-TMR, further experiments are required to quantify the response to higher levels of these legume ingredients as well as to evaluate the response feedlot feeding times for this legume diets.

Results from this experiment has demonstrated that steers fed H-TMR showed substantial difference in carcass characteristics as compared to those fed L-TMR. Furthermore, steers fed 365 days had heavier carcasses, greater fat thickness than steers fed 180 days. Further work is recommended to evaluate the effects of both nutritive value and the amount of hedge lucern mixture with TMR on carcass evaluations. However, as the numbers of animals used in this study was limited, further trials are needed to substantiate these effects.

LITERATURE CITED

Bartle, S. T. and R. L. Preston.. 1992. Roughage level and limited maximum intake regimens for feedlot steers. J. Anim. Sci. 70 : 3293.

Brandt, R. T., Jr. S. T. Anderson, and J. K. Elliott. 1987. Roughage levels in steam-flaked wheat finishing diets. Cattle Feeder Day. Prog. Rep. 518. 18-21 pp. Kansas State Univ., Kansas.

Campion, D. R., J. D. Crouse, and M. E. Distkeman. 1995. Predictive value of USDA beef quality grade factor for cooked meat palatability. J. Anim. Sci. 40 : 1225.

Chuaychuwong, N. 1997. A comparative study of fattening performance, carcass characteristics and economic return of breeds available in Thailand. Ph.D Thesis, Kasersart University, Bangkok.

Church, D. C. 1991. Livestock Feed and Feeding. Feeding growing-finishing beef cattle. 3 th ed. Englewood cliffs, New Jersey. 267 p.

Chyravate, K., P. Virapun, K. Karnda and B. Typha. 1993. The Supplement of Hedge lucern in Cattle. Annual Report 1993. Chainat Animal Nutrition Research Center. Group of Animal Nutrition. Department of Livestock Development. Ministry of Agriculture and Cooperative, Chainat, 6 p.

Corkum, M. J., L. A. Bate, A. Lirette and T. Termessen. 1994. Effects of flavoring agents on intake of silage by feedlot steers. Can. J. Anim. Sci. 77 : 262-265.

Davis, R. E., R. R. Oltjen, and J. Bond. 1963. High concentrate studies with beef cattle. J. Anim. Sci. 22 : 640.

Dufranme, I., M. Gielen, P. Lim bourge, C. van Eenaeme, and L. Istasse. 1995. Effects of grassing period on performance of finishing bulls: comparison with a indoor finishing system. Brit. Socie. Anim. Sci. 60 : 75-80.

Hedrick, H. B., J. A. Paterson, A. G. Matches, R. E. Morrow, W. C. Stringer, and R. J. Lipsey. 1983. Carcass and palatability characteristics of beef produced on pasture, corn silage and corn grain. J. Anim. Sci. 68 : 254-265.

Howard, R. and T. Plasto. 1993. Feedlotting (a guide for beef producers). Queensland Department of Primary Industry, Brisbane. 45 p.

Loeston, S. C. 1991. Efficacy of plastic pot scrubbers as a replacement for roughage in high-concentrate cattle diets. J. Anim. Sci. 69 : 2324.

McCaughey, W. P. and R. L. Cliper. 1996. Carcass and organoleptic characteristics of meat from steers grazed on alfalfa grass pasture and finished on grains. Can. J. Anim. Sci. 76 : 149-152.

NRC. 1984. Nutrient requirements for beef cattle. NAS-NRC, Washington, D. C.

Owens, F. M., D. R. Gill, D. S. Secrist, and S. W. Colemen. 1995. Review of some aspects of growth and development of feedlot cattle. J. Anim. Sci. 73 : 3152-3172.

Smith, G. C. 1990. Quality of beef from cattle fed solely on forage. J. Anim. Sci. 73 : 3152-3172.

Stock, R. A., M. H. Sindt, J. C. Parrott, and F. K. Goedeken. 1990. Effect of grain type, roughage level and monensin level on finishing cattle performance. J. Anim. Sci. 68 : 3441-3455.

Tatum, J. D., G. C. Smith, B. W. Berry, C. E. Murphey, F. L. Williams, and Z. L. Carpenter. 1980. Carcass characteristics, time on feed and cooked beef palatability attributes. J. Anim. Sci. 50 : 833.

Traxler, M. J., D. G. Fax, T. C. Perry, R. L. Dickerson, and D. L. Williams. 1995. Influence of roughage and grain processing in high-concentrate diets on the performance of long-fed Holstein steers. J. Anim. Sci. 73 : 1888-1900.

Typha, B., K. Chyravate, N. Karnda, and P. Virapun. 1993. Yield and nutritive value of Hedge lucern which different between cutting periods under irrigation system. Annual Report 1993. Chainate Animal Nutrition Research Center. Group of animal Nutrition. Department of Livestock Development. Ministry of agriculture and Cooperative. Bangkok. 8 p.

Waldren, D. D. and R. D. VanDyk. 1971. Effect of monosodium glutamate in starter rations on feed consumption and performance of early weaned calves. J. Dairy. Sci. 54 : 262.265.

White, T. W., W. L. Reynolds, and R. H. Klett. 1969. Roughage sources and levels in steer rations. J. Anim. Sci. 29 : 1001-1005.

Zinn, D. W., R. M. Durham, and H. B. hedrick. 1970. Feedlot and carcass characteristics of steers and heifers as influenced by day on feed. J. Anim. Sci. 31 : 302.

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