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A technique grass using a high crude Fibre to maintain the growth performance and improve blood health indicators in beef, central Vietnam

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Abstract

Sixteen beef cattle were divided into two groups (Trial 1 - Control, n = 8 beefs and Trial 2 - Experimental, n = 8 beefs) to evaluate the value of lemongrass (*Leptocarpus disjunctus* Mast.) as feed for cattle in the dry and flood seasons and aiming to develop beef farming, based on the nutritional value for growth maintenance and improve the haematology for health. Growth rate by period was also weighed, and blood samples were collected at 3 months intervals from Vena jugularis for analysis of red blood cell count: haemoglobin (HGB), mean corpuscular volume (MCV), mean corpuscular HGB (MCH), mean corpuscular haemoglobin concentration (MCHC), hematocrit (HCT), white blood cell count (WBC) between two groups are differences, $P < 0.001$ and differential leukocyte (lymphocytes -LYM), monocytes – MON, and granulocytes-GRA). The amount of all measured indices, hematocrit (HCT), white blood cell count (WBC) and differential white blood cell in the two groups, LYM, MON, and GRA percentages, were not significantly different from the control group and trial ($p > 0.05$). Therefore, the absolute and percentage values of LYM, MON, and GRA in trial 1 compared to trial 2 (eating a lot of lemon grass) are much better for resisting disease. The blood values of these analytes were in trial 1 (commercial feed and local grass species), giving higher indices.

Keywords: Beef Cattle, Blood health indicators, Central Vietnam, Grass technique, Growth performance, High crude fiber.

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1. Introduction

Beef cattle farming is increasingly essential in Vietnam's agricultural production system. From 2015 to 2024, the number of cattle in the country has continuously increased at an average of 3%/year. As of January 1, 2021, the Vietnamese cattle herd reached 6.4 million, of which the cattle herd in the Central region accounted for about 38%. However, cattle farming in Vietnam, in general, and the Central region, in particular, still faces many difficulties, mainly due to the lack of green food during the dry or flood season. In the Central region of Vietnam, the Lemon tree (*Leptocarpus disjunctus* Mast.), also known as another grass in Vietnam, is a type of tree with strong vitality, can withstand 2-3 months of flooding during the rainy season but can withstand the scorching heat on white sand in the summer. The tree has underground stems and leaves, complex tubular branches, usually over or under 1m high, about 3mm in diameter. Unless they are young, the tips of the branches and leaves often bear brown-yellow flowers like rice flowers. The Central region is an area that usually has storms. Other typical plants are easily damaged or have difficulty surviving when encountering storms. As for the Lemon tree, due to its structure, which is mainly small, hard and short tubular branches, it reduces the resistance to storms and the impact of flying sand. On the other hand, the Lemon tree branches are elastic and can lean in the direction of the wind, so they avoid breaking. The Lemon tree grows and is eliminated all year round. Where the Lemon tree lives, the sand surface is tightly protected by underground stems and a strong root system that clings deep into the sand layer, combined with branches and leaves on the ground to prevent flying sand. We can multiply the Lemongrass tree [1] in the arid sandy areas of the Central Coast to protect the environment, block sand, and provide food for cattle... This tree species needs to be protected and carefully studied and can be multiplied and planted in other localities with suitable environments. In the context of a lack of green food for cattle during the dry season, growing and developing Lemongrass [1] is necessary. However, up to now, the nutritional value of the lemongrass tree has not been evaluated, nor has cattle been able to use this food source. Publications on the nutritional value and the effects of the Lemongrass tree on the intake and digestion rate of cattle have not been found in any scientific documents. Therefore, we researched the topic: Evaluation of the value of the Lemongrass tree *(Leptocarpus disjunctus* Mast.) as food for cattle in Central Vietnam". Using *Leptocarpus disjunctus* Mast. as feed for cattle during the dry and flood seasons, aiming to develop beef cattle farming, based on: 1) evaluating the nutritional value of *Leptocarpus disjunctus* Mast. Through chemical composition analysis, the in vitro digestion rate is evaluated using the gas production technique and the rumen decomposition rate; 2) the feed value of *Leptocarpus disjunctus* Mast is assessed for cattle; (3) improving business results and income of beef cattle farmers.

2. Materials and Methods

Figure 1.
Pictures of grass growth and field survey.

Chemical composition and nutritional value of *Leptocarpus disjuncts Mast* at different harvest times: pre-flowering, flowering, and post-flowering are pooled and fed to beef for growth and blood health indicators, as shown in Figure 2. All

the samples were analyzed at the Laboratories of the Faculty of Animal Husbandry and Veterinary Medicine, University of Agriculture and Forestry, Hue University, Figure 1 shown and Medlatech, and the grass was planted at the Institute of Development Research, University of Agriculture and Forestry, Hue University, Thua Thien Hue province.

Figure 2.
Feeding for beef at trials

2.1. Materials, Animals and Experimental Site

Eight beef cattle were randomly arranged into two groups for testing, and each group had four cattle divided into batches to test the ability to digest, grow, and measure blood physiological indicators. The experiment was conducted at Phong Hien commune's Huong Tra, Thua Thien Hue province, now Hue City. *Leptocarpus disjunctus* Mast was transferred to the laboratory, dried at 60°C, then finely ground through a 1 mm) mixed in proportion to the ratio based on two groups of cattle (trial 1 – Control with commercial supplement and local grass species) and trial 2 – Experiment with Chanh Luong grass). Chemical composition analysis was performed by pooling and mixing to put the cattle and feeding them through the daily ration of two diets for two trials. Table 1, calculated by DM.

2.2. Feed Preparation

Lemon grass was harvested and processed and brought to the experimental farm to drain, but the freshness of the grass was still ensured for feeding the cattle.

2.3. Experimental Design

The cattle were fed with adapted feed for 7 days and a fed duration of 9 months, and then samples were collected for 10 days each. The beefs were fed freely for experimental lemongrass (trial 2), and the control group was fed commercial feed and local grass species (trial 1). Blood was taken for testing (HGB, HCT, MCV, MCH, and MCHC) for each period: 6, 9, 13, and 16 months of the growing stages of beef. The lemongrass was weighed before and after feeding. The cattle were fed 3 times daily (7:00, 13:00, and 19:00) according to the exact schedules for the two groups, and the overleaf feed was weighed the next morning. Feed intake was calculated using kg of dry matter/day and % body weight, and the control group was fed commercial feed based on local grass species.

2.4. Analysis and Management

Collected data were managed using Excel software (2019). Comparison of mean values between treatments based on ANOVA analysis and TUKEY test with significance level ($P < 0.05$) using Minitab 19.0 program. Parameters shown in the tables include mean value and standard error of mean SEM (Standard Error of Mean).

3. Results and Discussions

The chemical analysis of the lemongrass in all indicators except CF showed no difference ($P > 0.05$). Table 1 shows that DM, CP, EE, CF, ADF, NDF, and Ash were the other grasses that were lower. The results of the chemical composition analysis obtained in Table 1 show that the DM obtained is 39.57 - 45.23%, lower than Tran Van, et al. [2] when analyzing the DM of (VA06 Elephant grass, Hamil Guinea grass, Mulato grass and Ruzi grass) respectively (15.52%, 21.54%, 21.63% and 25.58%); higher than the DM above (TD58 grass, VA06 grass, Mulato II grass, Ruzi grass and Paspalum grass) respectively (23.70%, 15.70%, 22.33%, 23.20% and 20.63%) of Nguyen, et al. [3] and a higher than Nguyen, et al. [4] and Ta Van, et al. [5] conducted but a lower than Feather Grass at 8.75% [6] showed, respectively as reported by Nguyen, et al. [3] for the species, reported by Tran Van, et al. [2]; lower than Ash grass varieties: Lemongrass is 10.10%, Elephant grass is

9.87%, Paspalum grass is 12.07%, Ruzi grass is 8.67% and Sweet Sorgho grass is 12.06% [4] lower than Ash grass is 12.9%, some others reported by Tran Van, et al. [2]; Ta Van, et al. [5]; Duc [7] and Dang and Ha [8]. However, there is a negative correlation between gas production potential and ADF and NDF. This result is consistent with the conclusion of Kazemi, et al. [9] when evaluating the biogas potential of green forages (*Lucerne, Eruca sativa, Crocus sativus, Cardaria draba, Setaria* Spp., and *Triticum aestivum* forages) for ruminants in Iran.

Table 1.
Chemical composition, nutrient values of Leptocarpusdisjunctus Mast.) and dietary experimental setting -up for beef duration of 10 months feeding by %DM, n = 30 were pooled pre-flowering, flowering and post-flowering cutting.

Variables	**DM**	**CP**	**EE**	**CF**	**ADF**	**NDF**	**Ash**
M ± SE	41.73±2.27	6.05 ±0.33	1.80 ±0.21	43.58±2.77	41.83±2.43	70.10±3.63	2.37±0.25
TDN (total digestible nutrients); DMI(dry matter intake); DMD (dry matter digestible); RFV(relative feeding value); RFQ (relative fibre quality) (%) by DM (dry matter)			TDN	DMI	DMD	RFV	RFQ
			50.28±2.57	1.71±0.14	56.32±2.27	74.78±3.32	70.95±2.41
Dietary composition /Trails	Commercial feed (%)	Molasses (%)	Elephant grass (%)	Giene grass (%)	Lemon grass (%)	Soil bean meal (%)	Rice bain (%)
1 (n=8)	10	3	40	40			7
2 (n=8)		3			80	10	7
	DE (Kcal)	CP (%)	CF (%)	EE (%)	Fat (%)	Ash (%)	Na (%)
1 (n=8)	1824.25±37.12	8.25±1.24	41.12±0.67	5.25±0.41	3.25±0.26	2.13±0.14	0.5
2 (n=8)	1789.35±41.22	7.81±0.96	52.22±1.78	4.75±0.33	2.95±0.31	2.02±0.21	

Note: DE, Digestible energy; CP, crude protein; CF, crude fibre; EE, crude fat; ADF, insoluble fibre in acid detergent, NDF, insoluble fibre in neutral detergent; Ash, mineral; all by DM, dry matter.

3.1. Nutritional Value Through Digestion in Beef Cattle

The results presented in Table *1 also* show the total digestible nutrients, dry matter intake, digestible dry matter, relative feeding value and relative fibre quality *and* total digestible nutrients, *50.28±2.57 by pooled (pre-flowering, flowering, and* post-flowering), DMI (%), *1.71±0.14, much lower than other studies on* Lucerne, Eruca sativa, Crocus sativus, Cardaria draba, Setaria Spp., and Triticum aestivum reported by Kazemi, et al. [9] which were from 2.01 to 4.39%. *While DDM were* 56.32±2.27, it also was lower than the DDM results on the forages, which were from 64.75 to 72.54%. The RFV was 74.78±3.32, also lower than the RFV of the green forages, which was from 100.94 - 246.88%, and RFQ was 70.95±2.41, respectively.

As conducted by Kazemi, et al. [9] it was 83.31 - 250.36%.

3.2. Feed Intake and Weight Gain Efficiency of Beef Cattle by Feeding Months

It is essential to know how much cattle can eat day and night to know how much it can meet the animal's nutritional needs, thereby learning the ability to use the Lemongrass plant as feed for cattle. The experiment was conducted on 4 Brahman crossbred cattle, shown in Table *2*, which shows that cattle can receive Lemongrass. The amount of Lemongrass received is 13.29 - 14.43 kg/day/head of fresh food, equivalent to the amount of dry food received is 5.35 - 5.81 kg/day/head, accounting for 2.12 - 2.33% of body weight.

According to McDonald, et al. [10] the dry matter intake of beef cattle is estimated at 2.2% of body weight, while for dairy cattle, it is higher at about 2.8% of body weight at the beginning of the lactation cycle and 3.2% of body weight at peak intake. However, according to Preston and Willis [11] heifers (200kg) receive about 2.8 - 3% of body weight. Thus, the amount of Lemon grass consumed by cattle in this experiment is consistent with the above recommendations (2.12 - 2.33% of body weight).

According to Vu Duy, et al. [12] the amount of feed consumed by cattle is estimated to assess feed quality. Accordingly, the author proposed five recommended daily dry matter intake (% of body weight): 3.0 - very good; 2.5 - good; 2.0 - average, 1.5 - bad and 1.0 - very bad. Thus, according to the above assessment, the amount of feed consumed by cattle for Lemon grass is good (2.12 - 2.33% of body weight). The proportions of dry matter (DM), crude fiber (CF), acid detergent insoluble fiber (ADF) and neutral detergent insoluble fiber (NDF) increased gradually through the growth stages of the plant, crude fat (EE) was highest at the flowering stage, crude protein (CP) and total minerals (Ash) *also* decreased gradually *and maintenance by soil bean meal and rice brain in the experimental diet for beef.* Total digestible nutrients (TDN), dry matter intake (DMI), digestible dry matter (DMD), relative feeding value (RFV), and relative fibre quality (RFQ). Cattle receiving good quality lemongrass: 13.93 ± 0.35 kg/day/head of fresh food, equivalent to dry food intake of 5.61 ± 0.14 kg/day/head, accounting for 2.19 ± 0.15 and 2.59 ± 0.25; 2.19 ± 0.22 and 2.59 ± 0.33; 3.09 ± 0.21 and 3.29 ± 0.37 of the body weight, respectively with significant different between trial 1 and 2, with $P < 0.05$.

Table 2.
Maximum feed intake of Lemongrass for beef cattle and growth rate

Variables	N	M ± SE	Growth performance (g/ngày), n = 8	
			Trial 1 (M ± SE)	Trial 2 (M ± SE)
Feeding stage (6 – 9 months)				
Cattle weight (kg) and DG (g)	8	103.25 ± 4.20	$430.35^{a} \pm 25.17$	$402.24^{b} \pm 35.21$
FFI (kg/day/head)	8		$13.93^{ab} \pm 0.35$	$15.03^{ac} \pm 1.35$
DMI (kg/day/head)	8		$5.61^{a} \pm 0.24$	$6.21^{b} \pm 0.64$
CPI	8		$0.86^{ab} \pm 0.21$	$0.76^{ac} \pm 0.22$
% of body weight	8		$2.19^{a} \pm 0.15$	$2.59^{b} \pm 0.25$
Feeding stage (10 – 13 month)				
Cattle weight (kg) and DG (g)	8	153.25 ± 6.20	$470.35^{a} \pm 25.17$	$432.24^{b} \pm 35.21$
FFI (kg/day/head)	8		$15.33^{ab} \pm 0.57$	$17.12^{ac} \pm 2.14$
DMI (kg/day/head)	8		$6.89^{a} \pm 1.02$	$7.27^{b} \pm 0.98$
CPI	8		$1.86^{ab} \pm 0.45$	$0.96^{ac} \pm 0.23$
% of body weight	8		$2.19^{a} \pm 0.22$	$2.59^{b} \pm 0.33$
Feeding stage (13 – 16 months)				
Cattle weight (kg) and DG (g)	8	233.25 ± 8.20	$570.35^{a} \pm 25.17$	$602.24^{b} \pm 45.37$
FFI (kg/day/head)	8		$15.93^{ab} \pm 1.26$	$19.12^{ac} \pm 1.67$
DMI (kg/day/head)	8		$6.98^{a} \pm 1.08$	$7.33^{b} \pm 1.02$
CPI	8		$1.36^{ab} \pm 0.52$	$1.76^{ac} \pm 0.69$
% of body weight	8		$3.09^{a} \pm 0.21$	$3.29^{b} \pm 0.37$

Note: (FFI, Fresh feed intake; DMI, dry matter intake; CPI, crude protein intake) and SE: standard error of the mean; a, b, c, ab, ac: numbers with different superscript letters in the same row are statistically different ($P < 0.05$).

Table 3.
Changes in the values of erythrocytes, HGB, MCV, MCH, MCHC, HCT, thrombocytes, leukocytes, LYMs, MON, and GRAs (Absolute counts and percentage) in cattle: control (Trial 1) and demonstrating "Leptocarpusdisjunctus Mast was balanced by soil bean meal" (Trial 2),

Trials	Erythrocytes (10^{12}/l)	HGB (gm/l)	Haematocrit (%)	MCV (fl)
1 (n = 8)	7.25 ± 0.76	108.73 ± 9.10	25.89 ± 4.15	62.8 ± 7.2
2 (n = 8)	6.48 ± 0.95^{ns}	102.20 ± 11.23^{ns}	24.65 ± 3.37^{ns}	70.4 ± 8.8^{ns}
Trials	MCH (pg)	MCHC (gm/l)	Thrombocytes (10^{9}/l)	
1 (n = 8)	14.74 ± 2.12	382.80 ± 11.55	435.60 ± 42.30	
2 (n = 8)	14.94 ± 2.02^{ns}	384.78 ± 12.41^{ns}	362.67 ± 28.32^{ns}	
Trials	Leukocytes (10^{9}/l)	LYMs (10^{9}/l)	GRAs (10^{9}/l)	MONs (10^{9}/l)
1 (n = 8)	10.31 ± 0.81	5.36 ± 0.43	2.52±0.24	0.92 ± 0.066
2 (n = 8)	8.87 ± 0.33^{ns}	6.35 ± 0.40^{ns}	2.64 ± 0.19^{ns}	0.81 ± 0.058^{ns}
Trials	LYMs (%)	MONs (%)	GRAs (%)	
1 (n = 8)	66.63 ± 5.86	7.96 ± 0.59	25.89 ± 1.71	
2 (n = 8)	65.34 ± 4.19^{ns}	8.01 ± 0.67^{ns}	24.65 ± 1.87^{ns}	

Note: A, b, c, d, ab, ac in the same in row with difference with $P < 0.05$; MCV: Mean corpuscular volume; MCH: mean corpuscular haemoglobin; MCHC: Mean corpuscular haemoglobin concentration.

3.3. Crude Fiber Ratio in the Diet and Some Blood Parameters of Beef Cattle

The white blood cell picture parameters showed no statistically significant alterations ($p > 0.05$) in total leukocyte counts, as well as in both absolute values and percentages of LYMs, MONs, and GRAs in control cattle (Trial 1) compared to those exhibiting the abnormal tongue rolling oral hyperactivity [13]. Calcium, inorganic phosphorus, magnesium, plasma total protein, blood glucose, total bilirubin, urea, creatinine, chlorides, cholesterol, triglycerides, and albumin are concentrated. The blood values of these analytes in control and lemon grass-feeding cattle are shown in Table 3. The analysis of blood concentrations of RBC indices (MCV - Mean Corpuscular Volume, MCHC - Mean Corpuscular Hemoglobin Concentration, and MCH - Mean Corpuscular Hemoglobin) [14, 15] might help determine the type of anaemia (regenerative versus non-regenerative). The reticulocyte count does not need to be corrected in cattle. Total protein (TP) levels are usually interpreted with the PCV, and hydration status must also be considered [16-18]. The clinician often will already know acute blood loss has occurred from the history and physical examination. In my experience, there is no magic value for PCV (Positive Crankcase Ventilation Valve) and TP (total protein) when deciding whether a transfusion is necessary. Many times, the animal's condition will lead to a decision. The values of the red blood picture parameters are presented in Table 6. The amounts of all measured indices hematocrit (HCT), white blood cell counts (WBC), and differential white cell counts in 2 groups of beef cattle: lymphocytes (LYM), monocytes (MON), and granulocytes (GRAs) as absolute values and percentages in the blood of beef fed by lemon grass were insignificant difference from those in the control cattle group ($p > 0.05$). Parameters of the white blood cell picture showed no statistically significant alterations ($p > 0.05$) in total leukocyte counts, as well as in both absolute values and percentages of LYMs, MONs, and GRAs in control cattle (trial 1) compared to those exhibiting the experimental Trial - 1 fed the lemon grass eating more in dietary composition, it was much better for resistance to diseases. The blood values of these analytes were in the control group with commercial composition and local grass species for higher indicators.

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