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Potential of farm-rejected banana fruit (var. Cavendish) as feed for feedlot cattle

[Potensi buah pisang (var. Cavendish) tolakan ladang sebagai makanan lembu fidlot]

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Key words: farm-reject, feedlot ration, metabolisable energy, trace minerals, Bramas calves, digestibility

Abstrak

Kajian telah dijalankan untuk menentukan nilai pemakanan buah pisang (var. Cavendish) tolakan ladang sebagai makanan ternakan ruminan. Analisis proksimat menunjukkan bahawa kandungan protein, serabut dan mineral makro rendah dalam buah pisang. Akan tetapi, buah pisang ini tinggi dalam kandungan tenaga kasar dan mineral mikro. Hasil daripada ujikaji menunjukkan kesan positif rangsum yang mengandungi pisang terhadap pertumbuhan anak lembu jantan Brahman x Kedah-Kelantan (Bramas). Makanan ini meningkatkan kebolehcernaan bahan kering diet keseluruhan yang seterusnya meningkatkan pengambilan makanan.

Pertambahan berat badan harian anak lembu jantan yang diberi rangsum mengandungi buah pisang (terutama pada 50% dan 75%) didapati lebih tinggi daripada kumpulan anak lembu yang diberi rangsum tanpa buah pisang. Walaupun kecekapan penukaran makanan kepada daging didapati rendah, rangsum yang mengandungi pisang (50% dan 75%) lebih murah dan berupaya memberikan keuntungan yang tinggi, terutama rangsum yang mengandungi 75% buah pisang.

Abstract

A study was conducted to determine the nutritive value of farm-rejected banana (var. Cavendish) fruit as ruminant feed. Proximate analysis showed that the fruit was low in protein, fibre and macro-mineral contents. However, banana fruit had fairly high energy content and it was a good source of trace minerals. Results of the feeding trial showed that the inclusion of banana fruit had a positive effect on the growth of Brahman x Kedah-Kelantan (Bramas) bull calves. It increased the dry matter digestibility of the total diet which in turn resulted in higher feed intake.

The bulls showed better average daily gains when fed diets containing banana fruit (especially at 50% and 75% inclusion). Even though the banana fruit diets were inferior in feed conversion ratio to the control, they were more favourable in terms of feed cost per kilogram weight gain, especially with the 75% banana fruit diet.

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Introduction

Most agricultural wastes which are considered as potential sources of livestock feeds in Malaysia, are virtually underutilised. Banana plant which is traditionally grown as an inter-crop, produces a large amount of wastes such as the stem, leaves and discarded fruit. Today, banana, especially the Cavendish variety, is commercially cultivated as a single crop in large scale plantations mainly for export market. About 20% of the daily harvest failed to meet the required export standard and are rejected in the grading farm. Although efforts have been made to convert these farm-rejected fruit into banana flour for industrial use, the technology has not been commercialised. So far, there has not been any report on the use of these rejected fruit for livestock feeds in Malaysia. This paper reports a study on the effect of feeding banana fruit on the growth of Bramas (Brahman x Kedah Kelantan) bull calves.

Materials and methods

Twenty-eight Bramas male calves of about 8–10 months of age were randomly divided into four groups of seven animals. Each group was randomly allotted to one of the four diets containing different concentrate-banana fruit combinations. Diet 1 contained 100% concentrate only while diets 2, 3 and 4 contained concentrate plus 25, 50 and 75% of banana fruit (dry matter basis) respectively *(Table 1).* The purpose was to determine the amount of banana fruit on dry matter (DM) basis that can replace the concentrate in a cattle diet. The diets were not formulated to be isonitrogenous. All feeds were offered ad libitum with free access to water. The animals were allowed 2 weeks of adaptation period followed by an experimental period of 18 weeks. During the experimental period, data on daily feed intake, initial and monthly live weight were recorded and averaged for each group. Samples of fresh green banana fruit and the experimental diets were taken at monthly intervals, oven-dried, ground and composited for nutrient composition analysis (AOAC 1980). Blood was sampled from all animals at bi-monthly intervals and the plasma separated, frozen and analysed for mineral composition. The experiment was a completely randomised design and growth data were statistically analysed using least squares analysis of variance (SAS Institute Inc. 1985).

Table 1. Composition of the experimental diets

Diet	Concentrate (%)[1]	Fresh banana (%)[2]	Cost (RM/kg)[3]
1	100	0	0.39
2	75	25	0.32
3	50	50	0.25
4	25	75	0.17

[1]Comprised 60% PKC, 30% POME, 9% soybean meal and 1% vitamin-mineral premix, on dry matter basis

[2]The fruit at green stage of ripeness were used 1–3 days after harvest

[3]Based on the cost of concentrate at RM0.39/kg and banana fruit at RM0.12/kg

Four digestion trials were also conducted each using four Bramas bull calves to determine the DM digestibility of the four diets. Each trial lasted 15 days with a 10-day adjustment and 5-day collection period. Each diet was fed ad libitum on days 1 through 9. On day 10, an amount of feed equivalent to 90% of the average daily ad libitum intake, established on days 3 through 9, was estimated. Each calf was fed this amount daily during the collection phase. Water was freely available to each calf at all times. Feed samples were taken daily during the collection phase, composited and stored pending analysis. Faeces was weighed daily and a 10% sample was collected from each calf, composited and stored in the freezer pending analysis. The calves were exercised for 5 days at the end of each period.

Results and discussion

The proximate analysis of the diets showed that all nutrients decreased as the percentage

inclusion of banana fruit was increased, except the metabolisable energy (ME) value *(Table 2).* Due to the fairly high energy content of banana fruit, the energy content of the diet increased with increasing level of banana fruit. Banana fruit contained 2.36 Mcal/kg ME which is considered high for an agricultural by-product. However, its protein, fibre and ash (particularly macro-minerals) contents were low. This result is comparable with that reported by Devendra (1979) on other banana species. Banana fruit is also a good source of trace minerals and vitamins (Wan Zahari et. al 1994). All diets containing banana fruit (diets 2, 3 and 4) were found to have significantly (p <0.05) higher DM digestibility values than the diet without banana fruit (diet 1). Diet 2 (25% banana fruit, DM basis) showed the highest DM digestibility (77.4%) as compared with the other diets.

Diet containing banana seemed to have a positive effect on the growth performance of the experimental animals (*Table 3*). Average live weight gains of animals in groups fed diets with banana fruit (diets 2, 3 and 4) were greater (p <0.05) than the 100% concentrate group. The average daily gains of animals in groups 1, 2, 3 and 4 were 0.64, 0.70, 0.75 and 0.75 kg respectively. The higher gain from diets with banana fruit could be related to the daily feed intake and DM digestibility coefficients which tended to increase with increasing banana fruit level. The DM intake showed by groups 1, 2, 3 and 4 were 4.77, 6.45, 6.13 and 7.97 kg respectively. Banana fruit inclusion in the diets for bull calves also seemed to have improved the DM digestibility coefficient *(Table 3).* However, the control had better feed conversion ratio than those fed diets with banana fruit. Feed cost per kilogram weight gain value was used to compare the monetary gain between the experimental diets. In terms of feed cost to produce a kilogram of weight gain, diets 3 and 4 were less expensive than either diet 2 or the control diet. Feed cost calculated per kilogram weight gain basis for diets 3 and 4 were RM2.00 and RM1.83 respectively, as compared with RM2.91 for either diet 2 or the control diet. As shown in *Table 3*, the cost of feed dropped as banana fruit content was increased from 25% to 50% and 75% in the diet. Increasing the percentage of banana fruit had also resulted in the positive changes in average daily gain of the animals.

Plasma mineral analysis of the blood samples taken from the experimental animals in the feeding trial also showed positive result. Diets with banana fruit generally showed higher content of plasma trace minerals than the control *(Table 4).* The higher content of plasma phosphorus and calcium in the groups fed with banana-added diets might be due to the higher consumption of these minerals from the high-phosphorus mineral lick block provided to all groups during the experiment. The combination of high ME value and trace

Table 2. Nutrient composition and dry matter digestibility value of the experimental diets

Diet	Crude protein (%)	Fat extract (%)	NDF (%)	ADF (%)	Ash (%)	Ca (%)	P (%)	Mg (%)	ME (Mcal/kg)	Dry mater digestibility (%)
1	17.4	2.90	75.32	36.41	7.94	0.46	0.74	0.43	2.26	56.8a
2	15.5	2.70	66.77	31.51	6.23	0.37	0.59	0.36	2.28	77.4b
3	13.6	2.43	58.21	26.61	4.52	0.27	0.44	0.29	2.31	75.3b
4	11.8	2.15	49.66	21.70	2.81	0.18	0.29	0.23	3.33	71.3b

Mean values with different letter differ significantly (p <0.05)
Banana fruit contained 42.0% DM, 5.45% CP, 2.38% CF, 0.89% EE, 35.8% NFE, 0.51% ash, 2.36 Mcal/kg ME, 1.54% K, 399 ppm Ca, 684 ppm P, 276 ppm Na and 581 ppm S, on dry matter basis

Table 3. Growth performance of Bramas bull calves

Diet	Animal no.	Initial body weight (kg)	Final body weight (kg)	Total gain (kg)	Daily gain (kg)	Feed intake (kg)			Feed conversion ratio	Feed cost/ kg gain (RM)
						Concentrate	Banana fruit	Total		
1	7	191.0	278.0	87.0a	0.64a	4.77	–	4.77a	7.45a	2.91
2	7	180.0	275.7	95.7b	0.70b	4.80	1.65	6.45b	9.21b	2.91
3	7	192.3	295.3	103.0b	0.75b	3.00	3.13	6.13b	8.17ab	2.00
4	7	170.5	273.5	103.0b	0.75b	1.97	6.00	7.97b	10.63b	1.83

Mean values in each column with different letter differ significantly *(p <0.05)*
Cost of feed: diet 1 at RM0.39/kg, diet 2 at RM0.32/kg, diet 3 at RM0.25/kg and diet 4 at RM0.17/kg

Table 4. Plasma mineral composition of the experimental animals

Diet	P (ppm)	K (ppm)	Ca (ppm)	Mg (ppm)	Mn (ppm)	Fe (ppm)	Cu (ppm)	Zn (ppm)	Na (ppm)	S (ppm)
1	63.44	101.31	67.50	9.94	0.59	122.94	0.62	3.94	2 311.06	721.25
2	72.19	119.31	79.62	12.56	0.12	34.69	0.69	3.87	2 424.50	784.50
3	82.94	120.31	80.06	13.12	0.81	153.12	0.69	3.75	2 404.31	752.06
4	66.31	99.75	68.00	11.44	1.00	104.87	0.69	4.06	2 400.31	672.37

mineral in banana fruit might have contributed to the higher daily gain in animals fed the banana fruit diets (diets 2, 3 and 4) as the requirement for magnesium is especially high for animals being fattened (NRC 1970). Magnesium together with calcium and phosphorus are vital in the development of bones, hormones, enzyme activities and is an essential component of blood plasma (Underwood 1966). Magnesium from the diets with banana could also contribute to the better growth performance of the calves. Magnesium is also essential in specific body processes such as nutrient metabolism and enzyme activation. Potassium which is exceptionally high in banana fruit, is important in the body fluid for control of osmotic pressure as in nutrient absorption and nutrient metabolism. All these have effectively contributed to the better performance of animals fed with banana-added diets.

Conclusion

Farm-rejected banana fruit could be used as an energy feed for fattening of beef cattle. Inclusion of banana fruit in the diet at 50% and 75% has resulted in good animal body weight gain. Although proximate analysis of the fruit samples showed that protein, fibre and macro-mineral contents were low, banana fruit has a fairly high energy content and it is a good source of trace minerals which can be used as feed for ruminants. A diet containing 75% banana fruit produced an average daily gain of 0.75 kg in Bramas cattle with a feed cost of RM1.83 to produce one kilogram of body weight gain.

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