Production and Utilization of Fresh Fodder from Containerised Hydroponics System

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Introduction

Consistency in quality and production of a high quality fodder is in essence for a successful animal production system. The cost of pasture production and the competitiveness of land for other uses have generally affected the opportunity and cost of ruminant production in many developing countries. In Malaysia, a good pasture yield 25-30 metric ton dry matter/yr./hectare and cost approximately RM2500/hectare to develop. In addition, tropical soil and forages are known to be deficient in several essential minerals and nutrients. The digestibility of the forages is generally low and hence releases low metabolisable energy to support high nutrient requirement of the animals. Cost of feed normally amount to 70% of the daily operational cost in a livestock farm particularly the equine and cattle farms. The benefits of soil-free fodder production in a containerised system from cereal such as barley are enormous and proven successful in many semi-arid and desert countries. This includes disease-free, superior nutritive value and high animal productivity including greater milk yield, improved fertility and faster growth (Peer et al. and Leeson, 1985). Technically, the operation is easy and economical where 1 metric ton of fresh fodder is produced daily from a 40m^2 environment controlled container. The production cost was estimated 35sen/kg fresh fodder.

The project aims to develop a suitable feeding system based on sprouting barley fodder produced from containerised hydroponic system for high yielding ruminant and horses. An important goal of this project will be to seek outcomes of introducing the sprouting barley and other cereal grains to increase productivity of animals that require high nutrient requirement. Four key areas will be studied including yield of fodder, nutritive values, digestibility and feed intake.

Materials and methods

The project was divided into four sections: (i) setting of the system, (ii) growth of the fodder in the controlled environment, (iii) an evaluation of the nutritive values including digestibility using rumen simulation technique (RUSITEC), (iv) feeding trial in dairy goats and (iv) economics assessment. The fabricated containerised system was set up on a level and hard ground. The container was cleaned and within 5 days, the system was ready to be used for germination of the seeds. The seeds were soaked for 2 hours and spread out evenly in the trays that were arranged on several slotted panels. 140kg seeds were germinated daily to produce approximately 1000 kg of fresh sprouting barley in an 8-day growth cycle.

During the germination process and growing process of 8 days, samples were randomly collected daily and analysed for nutrient contents and nutritive values. Rumen simulation technique (artificial rumen technique) was used to assess digestibility and fermentation pattern of the sprouting barley of 1 to 8 days of age. Digestibility trial using 4 male *Saanen* goats (repeated 4x4 Latin Square Design) was conducted on 8-days old barley. The dry matter yield was also estimated. Samples of feed and faeces were analysed according to the methods of AOAC (1984).

Results and Discussion

The sprouting barley or commercially called barley fodder produced from the controlled system has high metabolisable energy content (12 MJ/kg DM) due to low fibre component. The average protein content was 17% (DM basis). Germinating 1kg barley grain produced approximately 7.5kg of fresh fodder, which means that there was no significant net loss of DM content before and after germination. The average apparent digestibility of the barley fodder by *in vivo* and *in vitro* techniques was 82.5%. The rates of degradation of the nutrients (dry matter and protein) by nylon bags techniques were rapid, indicating high digestibility of the fodder. The rumen ammonia concentration was high (>200mg/kg) and the pH ranged from 5.9 to 6.6 throughout the day. The propionic acid levels were predominant after feeding and ranged from 25 to 35% of the total volatile fatty acids composition. Fodder produced was free from fungus when the chamber and grains were kept cleaned under good sanitary practice. This was similarly reported by Capper et al. (1988). The nutritive characteristics of the fodder with respect to the nutrient composition and digestibility indicated that it should be used as high-energy source in the ration of livestock including swine(Ong *et al* 1997).

The container system that was operated to suit the environment for growing barley was also found suitable to grow several other grains such as beans, corn and paddy. The total yield of dry matter per unit weight of grains sown was not significantly different before and after germination. This shows the potential of using this system to grow fodder from grains, particularly corn that was palatable to the ruminants.

Conclusions

Containerised system offers an alternative approach to produce fodder from grains. Fodder produced was highly palatable and digestible. These characteristics are useful for feeding livestock with high demand for energy such as in horses and dairy animals. Economically, it was a viable unit to maintain and produce fresh feed (RM 0.26 / kg fresh wt) besides being water saving, environment friendly, less space is needed and clean production of feed.

Benefits from the study

The containerised system can be appropriately adapted to produce high quality fresh fodder. Other grains such as corn could also be used to produce sprouting corn fodder from the system. The cost of maintaining and operating the machine was approximately RM 3.80 daily and mainly attributed to air conditioning cost. The fodder had high nutritive values and was suitable for livestock that demand high energy. High digestibility, high soluble carbohydrate and crude protein contents plus good Ca:P ratio make the barley fodder a suitable feed for ruminants. The containerised system (for germinating barley production) was not a labour intensive system and most important, is the assurance of having a high quality feed daily to supplement the stocks.

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Graduate Research

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