# ENHANCING THE UTILIZATION OF LOCAL FEED RESOURCES AS STRATEGIES FOR RUMINANT FARMING

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## INTRODUCTION

Strategies for increased and sustained food production are necessary to meet the demand for the expanding population and security when food production and availability are easily jeopardized in crisis such as the effects of global warming and natural disasters. Today, we have seen evidences of global change in weather affecting agricultural production such as cereal harvest and yield and animal production. Weather changes affect agricultural activities, especially when it involves pre-planned schedule and natural disasters including drought and floods due to the El-Nino and La-Nina phenomena have disrupted planting and harvesting schedules of rice for example. Areas hit by flood had to re-schedule their planting as well as the harvesting process, but the question still remains on whether the soil would have ample time to recover after each planting season.

Climate can generally affect animal production in four ways: (i) the impact of changes in livestock feed-grain availability and price; (ii) impacts on livestock feed resources such as pastures and forage crop production and quality including the availability of by-products as feed; (iii) changes in the distribution of livestock diseases and pests; and (iv) the direct effects of weather and extreme events on animal health, growth and reproduction (Smit et al 1996). The impact of changes in livestock feed-grain availability and price has been mentioned even in several early studies (e.g. Adam et al, 1990; Rosenweig and Parry, 1994). The indirect effects of climate driven changes in animal performance result mainly from alterations in the nutritional environment as changes in climate would affect the quality and quantity of forage produced. The impact of climate change on pastures and rangelands can include deterioration of pasture quality, but there could also exist potential increases in yield if climate change were favorable as a result of increase in CO2 (Campbell et al 1995). As a consequence, productivity of grazing livestock could be altered (Topp and Doyle, 1996).

Also in recent years, there is increased farming for use in biofuels, increased world oil prices at more than $100 a barrel, loss of agricultural land to residential and industrial development and growing consumer demand in China and India. These are some reasons claimed to have pushed up the price of grain. In developing countries, often 70% or more of the population lives in rural areas. In that context, agricultural development among smallholder farmers and landless

people provides a livelihood for people allowing them the opportunity to stay in their communities. It appears that animal farming is much affected by these global scenarios irrespective of where we are located.

Therefore appropriate strategies are essential to sustain the local farming industry particularly the ruminants that are largely farmed in smallholder system in many tropical and developing countries. In these countries, ruminants are important animals both as source of daily protein food such as milk in dairy animals, draft purposes and also income from the sale of live animals or meat. While facing the reality of the issues of global concern, farming in the tropics is also faced with challenges that are broadly associated with animal's productivity, economics of farming, animals' genetics and land availability. Improvements are needed in these areas to ensure the sustainability of farming as an economic activity. This paper describes the strategic approach to enhance ruminant farming in particular, using feed resources that are accessible, manageable and logical to be adopted and practiced for sustained farming as an economic activity.

## ENHANCING THE UNDERSTANDING ON THE EFFICIENCY AND MAXIMIZING DIGESTION OF LOCAL FEED RESOURCES

Providing optimum nutrition appears the most challenging responsibility of farming ruminants by the smallholders. Ration must provide the nutritional requirement and also cheap to ensure animal could express its genetic potential and make farming cost sensible, respectively. Without doubt, the local feed resources, particularly low-quality roughages and agricultural crop-residues are of prime importance as basal feed for ruminants in the tropics. These feeds exhibit close relationships with rumen ecology, microbes and rumen fermentation patterns. A number of dietary factors could influence rumen fermentation especially the basal roughage source, its physical form and fermentation end-products. Diurnal fermentation patterns in ruminants fed on rice straw must be consistently maintained in terms of pH and temperature, but for NH3-N or VFAs.

Manipulating rumen fermentation through treatment of roughage and strategic supplementation with high quality feed sources such as cassava hay and other local feed resources particularly leguminous plants could improve rumen efficiency by maintaining higher pH, optimum NH3-N and increasing microbial protein synthesis and essential VFAs, and thus enhance ruminant productivity in the tropics. However, further research on the specific roles of these feeds in rumen fermentation and practical applications both by farmers and industries is still warranted. However in the tropics, most ruminants are fed on low quality roughages and industrial by-products which basically contained high levels of lingo-cellulosic materials, a low level of fermentable carbohydrate and a low level of good-quality protein. In addition, long dry seasons, a prevailing harsh and uncertain environment, especially high temperature, low soil fertility and less feed

available throughout the year, all influence rumen fermentation. Research in the tropics particularly in Asia should also deal with rumen ecology of ruminants and examining possible strategies available for manipulation of rumen fermentation for efficient uses of available local feed resources. Ruminants raised in the tropics largely depend on seasonal feed resources which are relatively low in quality. Hence, the manipulation of rumen efficiency through the use of local feeds would be an advantage. Possible means to improve rumen efficiency including increasing rumen NH3-N, supplementing rumen degradable carbohydrate and providing rumen by-pass protein through urea-treatment of roughage and strategic supplementation of the urea-molasses block or high quality feed block/pellet using local available feed resources.

Further research on a greater use of NPN (urea) and higher rumen degradable carbohydrate on high fibrous feeds, on rumen microbes as well as their practical transfers, on the use of fewer-ingredient feed systems, on the use of natural plant compounds in rumen manipulation e.g. tannins etc, warrant further undertaking. Moreover, any research and development should be based on simplicity, availability of local feed resources, the cost-profit of production and the sustainability of ruminant production systems in the tropics, particularly in lactating ruminants.

## ROLES AND SIGNIFICANCE OF FORAGES IN TROPICAL FARMING

Forages are important in the nutrition of goats and sheep as they form the natural and basal ration to meet most of their nutritional requirements. Provisions of forages of high nutritive values would ensure the sheep and goats sustain their productivity throughout the year while minimizing the use of the more expensive commercial concentrate. This strategy offers greater opportunity to increase and sustain profitability of the farming operation, whether it is for breeding, fattening or short-term rearing prior slaughter. The traditional ways of feeding and dependence on unimproved pastures, native or wild forages is insufficient to meet the daily nutritional requirement for good growth, pregnancy and lactation of these genetically improved sheep and goats. Seasonal availability, nutritionally inferior forages and low dry matter intake further add nutritional stress that reduces the productivity and productive life span of the breeder animals. There is total dependence on wild forages of low digestibility (<40%) and crude protein (<8%).

The humid tropical climate favours the growth and offers a large plant biodiversity providing sufficient biomass potentially utilized as feed throughout the year. However, there is underutilization of the various types of feeds, but it also means considerable opportunities for future use as feed for the increasing ruminant population (Devendra and Leng, 2011). The planting of leguminous trees as protein source is particularly most relevant where high biomass yields

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could be made available through the year. The foliages of some of these plant species have long been consumed as food in traditional diets of the rural population. Under smallholder farming system of sheep, goats and cattle, many species of tree forages are fed with good effects. Therefore, growing of tree crops of high nutritive values and pasture grass is essential and feeding the cultivated forages with agricultural by-products is an appropriate approach to sustain a long-term economic viability of intensively farmed goats and sheep.

Inability to grow forage is largely due to: (i) poor availability of suitable land, (ii) unavailability of planting materials including pasture seeds for the establishment of fodder plot and (iii) poor realization on the significance of growing forages and nutritional values of forages among the operators/farmers. Consequently, there is strong reliance to feed commercial concentrates to make up for the feed inadequacy at the expense of the cost of operation. Thus, feeds and feeding issues impose a much greater challenge to the expansion of the small ruminant farming sector at the risk of particularly phasing out of the smallholder farms.

As in the case of the smallholder dairy cattle farming in Asia, farmers are not aware of the cost and options of feeding. Overstocking, underfeeding forages and high supplementation with concentrates are most common (Moran, 2009). Notwithstanding the fact that smallholder farms are characterized by small herd size per farm basis, they constitute the bulk of the livestock population, indicating their significant contribution to the economy. The small farms are very dependent on fresh and dried forages to feed their goats and sheep and conservation of forages are necessary during times of inconsistent feed supplies (Mohd Najib, 2001). Nonetheless, they are vulnerable unless practical and economically viable solutions are designed to ensure the sustainability of their farming business.

## FODDER SPECIES

There is a need to broaden the forage resource base through the enhancement of development and identification of homegrown protein sources as alternative to commercial concentrates. The planting of leguminous trees is particularly most relevant where high biomass yields could be made available through the year. The foliages of some of these plants have long been consumed as food in traditional diets of the rural population. However, we have not successfully exploited the growing of some of these forages in a bigger way. Under smallholder farming system of cattle, sheep and goats, many species of tree forages are fed with good effects, but such forages do not appear as a ration.

The roles of fodder from trees (e.g. *Leucaena leucocephala*, *Gliricidia sepium*, *Sesbania grandiflora*, *Manihot esculenta* Crantz, *Morus alba, and Calliandra calothyrsus*) particularly as a source of protein has been well recognized and reported. This is deemed necessary to alleviate nutritional deficiencies associated

with feeding low quality feeds and to overcome limitations associated with the economics of feeding commercial concentrates. Furthermore, with the ban on the incorporation of animal-based proteins in feed, there have been increasing interests in the utilization of alternative non-animal based protein supplements for ruminants

In the context and intensive farming of sheep and goats, increasing emphasis must be laid on the fodder tree leaves as protein source given their unique properties, namely, year-round availability particularly in periods of shortages of basal roughages, high nutritive value, ease of accessibility to farmers, ease of adaptation to local agro-climatic conditions which largely account for their hardy nature. Furthermore, these fodder trees are known to have deep root systems which can tap underground water thereby imparting to them drought resistant. Growing of fodder trees or shrubs that are rich in protein will provide flexibility of choice and reduce feeding cost. The utilization of fodder tree in the ruminant production has been intensively documented and is much advocated for its significant contribution to the enhancement of the sustainability of the system, whilst enhancing the rumen conditions in animals fed low quality roughages (Rosales and Gill, 1997). This is one major highlight of fodder trees which supply readily fermentable substrates to the rumen microbes, thereby correct nutrient deficiencies associated with feeding low quality fibrous feeds. Alleviation of nutrient deficiencies in the rumen implies enhancement of the utilization of the basal forage with significant improvements in the overall nutrient utilization which is expressed in terms of improvement in digestibility and intake. Tree fodder may contain anti-nutritive factors, which can reduce its usefulness as a feed. However, there are tree fodder and shrubs such as cassava, jack fruits and leucaena with good nutritional potential and having anthelmintic compounds that help in controlling *Haemonchus contortus* (Daryatmo et al, 2010).

Mulberry: In the quest for alternative homegrown forages, the leaves of the mulberry plant have received considerable attention as a high quality protein supplement. Mulberry has been included in most forage evaluation studies in different parts of the world e.g. Vietnam (Nguyen and Le Duc, 2003), Greece (Kamalak et al, 2004) and India (Bakshi and Wadhwa, 2004), which is a reflection of the awareness of its nutritional potential. A larger area for the cultivation of mulberry can ensure a greater availability of the foliage throughout the year and made sufficient for the number of livestock. However, we have not emphasized the importance and contribution of these resources in the development of the cattle, goat and sheep farming. Mulberry is easily propagated and with good persistency under frequent repeated harvests yielding high quality biomass throughout the year (Saddul et al, 2004). Studies on the digestibility indicated that mulberry is suitable as a supplement, particularly to low-quality roughages in providing a

source of rapidly available nitrogen to the rumen microbes, hence improving the roughage degradability and intake (Saddul et al, 2005).

Cassava: As compared with the humid tropical zones, the farmers in the drier tropics face inadequate supplies of quality feed for their ruminant stocks under intensive farming, particularly during the long dry season. In north east of Thailand, the limited supply of quality roughage has critically affected the milk yield of the dairy cattle (Wanapat, 2005). The use of alternative feed sources such as cassava (*Manihot esculenta* Crantz) has become an increasingly important approach of feeding to ensure the animals are able to maintain good body condition through the periods of uncertain supply of quality feed. Cassava produces leaves of high crude protein content that could be turned into hay and the roots provide good source of energy when incorporated in the ration.

Moringa: Moringa foliage is also known for its high protein content, negligible tannins and saponins contents and undetectable trypsin inhibitors and lectins (Makkar and Becker, 1997). It has been long used for many purposes although without any systematic approach of cultivation and conservation. The biggest advantage of the plant is its fast growth and adaptation to the tropical and sub-tropical climate. The foliage is a potential feed resource for all livestock due to its high biomass yields and nutritive values (Manh, 2005). It can yield up to 20 MT DM of utilizable biomass in a growing cycle of 50 days. As a feed, the digestibility of groundnut hay was significantly improved following supplementation with *Moringa* foliage suggesting an improved fermentation in the rumen of the fibrous feed **(**Nouala, 2006). Feeding the leaves up to 50% level of total forage allowance provide a cheap protein supplement in tropical grass diets for goats (Aregheore, 2002).

There is a great possibility that there are variations in the nutrient contents and feeding characteristics of the fodder trees. When fodder trees are intensively cultivated and managed, it has high yield potential. With its high nutritive composition and easy establishment at smallholder or extensive scale, these fodder trees rightly deserve to be further researched as a feed for the small ruminants. The fodder trees must be grown intensively and on larger scales as many are shown to require minimum agronomic input.

## CONCLUSION

On-farm production of forages for feeding cattle, sheep and goats in intensive farming system is critical and must be planned before farming. Farmers must be less dependent on commercial concentrate as substitute of forages to make-up the dry matter requirement of the animals. On-farm forage production is the cheapest and most appropriate strategies in intensive farming. It is possible to supply at least 90% of the forages from within the farm through forage growing and conservation of forages. In addition, fibrous feed residues such as rice straw

should be outsourced to make the requirement of fibers for animals that require lesser nutrient requirement. I believe that sustainable development of ruminant farming in intensive system largely depends on the wider use of local feed resources such as own-grown forages and the use of agricultural by-products in the ration.

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