

## ILC2018 Keynote Paper\*

# Leucaena feeding systems in Myanmar

## *Sistemas de alimentación de ganado con leucaena en Myanmar*

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### Abstract

Agriculture and livestock provide the main source of income for farmers in Myanmar. As feeds with low nutritive value and digestibility are traditionally used for animal feed, alternative feed sources of better quality are needed to improve production levels. While concentrates can be used to improve the quality of diets, this leads to high feed costs. To solve this problem, researchers in Myanmar conducted trials to replace some concentrates with leucaena. The nutritive value of leucaena in Myanmar is relatively the same as found in other countries. Control of leucaena toxicity was also studied in Myanmar by isolating mimosine-degrading bacteria and managing the feeding of leucaena. While farmers in Myanmar are aware that leucaena can be fed to livestock and can be toxic to animals, they have limited knowledge of the real benefits of leucaena as a feed for animals. Research to demonstrate the potential of leucaena feeding to animals in Myanmar and efforts to promote establishment of leucaena stands are urgently needed.

**Keywords:** Feeds, nutritive value, tree legumes, tropical pastures.

### Resumen

La agricultura y la ganadería constituyen la principal fuente de ingresos para los agricultores de Myanmar. En vista de que tradicionalmente se usan forrajes de bajo valor nutritivo y digestibilidad para la alimentación animal, se necesitan fuentes de alimentación alternativas de mayor calidad para mejorar los niveles de producción. Si bien se podrían usar concentrados para mejorar la calidad de las dietas, esto conduce a altos costos de alimentación. Para resolver este problema, investigadores en Myanmar realizaron experimentos para reemplazar algunos concentrados con leucaena. El valor nutritivo de la leucaena en Myanmar es similar al que se encuentra en otros países. En Myanmar también se estudiaron el control de la toxicidad de la leucaena mediante el aislamiento de bacterias que degradan la mimosina, y el manejo de la leguminosa para la alimentación animal. Si bien los agricultores en Myanmar saben que la leucaena puede ser usada como alimento para el ganado, su conocimiento sobre los beneficios actuales de esta especie para la alimentación animal es aún limitado. En Myanmar se necesitan con urgencia tanto trabajos de investigación para demostrar el potencial de leucaena como alimento para los animales como apoyo para promover la siembra de leucaena.

**Palabras clave:** Forrajes, leguminosas arbóreas, pasturas tropicales, semilla, valor nutritivo.

### Introduction

Increasing human population densities highlight the priority that must be placed on efficient land use for the production of food and plantation crops. Globally, this demographic pressure leads to increased emphasis on the

development of productive and intensive livestock and agricultural systems ([Aung Aung 2007](#)). Livestock production contributes a large portion of household income in developing countries. The economy of Myanmar is largely based on agriculture and livestock are a vital component of the nation's economy; livestock and

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fisheries contribute about 9% of total GDP with the private sector contributing 99% of livestock production ([Hla Hla Thein 2017](#)).

Seventy percent of the population of Myanmar reside in rural areas and 64% of the population are farmers, who derive their main income from agriculture. Livestock production is closely linked with agriculture as farmers use cattle as draught animals and utilize agricultural by-products as feed. Some farmers raise pigs and village chickens as a small-scale backyard system. Smallholder livestock farmers obtain draught power, local transport and manure as fertilizer from their draught animals. Eggs, milk, meat and hides are products/by-products which contribute to household income ([Hla Hla Thein 2017](#)).

Crop residues are the main source of animal feed, especially during the dry period, with rice straw being the most abundant and widely used feed in many Asian countries including Myanmar ([Trung 1987](#)). These agricultural fibrous residues have severe nutritional limitations, being low in digestibility and crude protein, and high in fiber and anti-nutritional factors such as lignin, silica, gossypol, etc. To achieve satisfactory animal performance, supplementation with concentrates, which are expensive, is needed to overcome the nutritional limitations of the feeds.

Farmers in Myanmar currently use commercial feeds for monogastric animals, resulting in high inputs and costs. The other concern with monogastric animals is that they often compete with humans for food.

To solve these problems with ruminants and monogastrics, supplementation with fodder tree legume leaves was studied as leguminous forages are high in protein and soluble carbohydrates.

Leucaena (*Leucaena leucocephala*) is a palatable, digestible and nutritious forage for cattle, buffalo, sheep, goats, chickens and other animals ([ter Meulen et al. 1979](#)) as it provides a valuable source of protein, energy, vitamins and minerals for rumen bacteria ([van Tol 2004](#)) and is quite versatile. It can function: (a) as a source of firewood and timber; (b) in controlling soil erosion ([Dijkmann 1950](#)); (c) in providing shade for other plants; (d) in maintaining the fertility of the soil; (e) as a possible bio-herbicide ([Xuan et al. 2006](#)); (f) in reducing cattle methane emissions ([Shelton and Dalzell 2007](#)); and (f) as nutritious forage for animals ([NRC 1977](#)). Leucaena foliage and young branches supply both nutrients and roughage, forming an almost complete ruminant feed and being widely used as forage for cattle in tropical agriculture ([Shelton 1998](#)). It can also be utilized for monogastrics. D'Mello and Thomas ([1978](#)) demonstrated that the N-corrected metabolizable energy (ME) for poultry is  $8.3 \pm 0.74$  MJ/kg DM. Gieseke ([1984](#)) stated

that leucaena leaves contained  $4.39 \pm 0.8$  MJ/kg DM and seeds contained  $4.19 \pm 1.8$  MJ/kg DM. In Myanmar, leucaena is used as a protein source in urea-molasses multi-nutrient blocks for ruminants ([Ni Ni Maw et al. 2002](#)) and is a potential feed for animals in the dry season ([Aung Aung 2018](#)). However, there is still limited information on leucaena in Myanmar. This paper describes the research carried out and feeding systems involving leucaena in Myanmar.

## Nutritive value of leucaena in Myanmar

As in other countries, research workers in Myanmar have conducted research on the nutritive value of leucaena (called Bawzagaing in Myanmar) as an animal feed ([Mehm Ko Ko Gyi 2002](#)).

Concentrations of various nutrients in leucaena leaves are as follows: crude protein (22.2–30.1%), neutral detergent fiber (8.2–28.6%), acid detergent fiber (6.6–20.0%) and ether extract (5.3–8.2%) ([Ni Ni Maw et al. 2002](#); [Khin Htay Myint 2005](#); [Wink Phyto Thu 2010](#); [Moe Thida Htun 2012](#); [Dezin Soe Lwin 2014](#)).

Nutritive value of leucaena reported from different regions and seasons showed little variation and was similar to results from other countries.

## Experiments on feeding leucaena to animals

### Ruminants

Many researchers in Myanmar have conducted feeding trials involving leucaena diets for ruminants. In the experiment of Khin Htay Myint ([2005](#)), diets for goats based on rice straw with leucaena at 25 and 50% of the diet showed similar nutrient digestibilities to diets containing rice straw and sesame cake (all diets isonitrogenous at 18% crude protein). However, in the experiment of Aung Aung ([2007](#)), sheep fed a diet containing 40% leucaena showed toxic symptoms and lower digestibilities of nutrients than sheep fed a diet without leucaena. In this experiment, it was also discovered that sheep could be fed leucaena at 30% of the diet without adverse effects as was reported by Jones ([1979](#)), while Moe Thida Htun ([2012](#)) reported similar findings to those of Aung Aung ([2007](#)). However in contrast, another experiment reported no adverse effects in sheep fed a diet containing 50% leucaena ([Wink Phyto Thu 2010](#)) with the same digestibility as for sheep fed on a diet without leucaena. Recently, goat kids fed a diet containing 30% leucaena increased liveweight at a rate of 80 g/d ([Khin Ngu Wah Htun 2018](#)); fecal worm egg counts were reduced by 70%. Yin Moe Aung ([2018](#)) also

showed that including leucaena at 30% in a diet for calves reduced fecal worm egg counts, while Han Zin Maung (2018) showed that calves fed a diet containing 30% leucaena had comparable weight gains with calves fed a conventional feed without leucaena. Feed cost was lower in the calves fed diets containing leucaena.

### Poultry

Small-holders use leucaena as a green feed for poultry to aid in the prevention of cannibalism. Aye Kyi (2003) compared different levels of leucaena leaf meal (0, 2, 4 or 6%) included in a conventional concentrate ration for layer hens for 15 weeks. Hens fed on the diet containing 4% leucaena showed higher egg production (88%) than hens fed the other diets (85.1, 84.7 and 84.8%, respectively). A similar experiment with broiler chickens (0, 1, 3 and 4% of leucaena in the diet) was conducted by Aye Aye Maw (2004). In her experiment, feed conversion ratio (FCR) of chickens fed on the diet containing 4% leucaena also showed the highest value. In both experiments, supplementation with leucaena showed lower feed costs for the poultry. Although mild symptoms of leucaena toxicosis such as goitre and weakness of bones were observed, there was a tendency for FCR for broiler chicks fed on diets containing 6% leucaena seed to be better than for those on a conventional diet (Khin Thida Win 2014). In another experiment, Naing Htun Aung et al. (2015) recommended that 4% of leucaena leaf meal should be included in the diet of chicks from 21 days of age (because economic returns in the broilers were better and there were no serious adverse effects).

### Leucaena toxicity and attempts to overcome this problem in Myanmar

Researchers in Myanmar offered leucaena to animals as the sole diet but encountered problems. Sheep fed a diet containing 50% leucaena showed symptoms of toxicity such as decreased feed intake, alopecia and emaciation (Aung Aung 2007) plus regurgitation of green digesta (Moe Thida Htun 2012). When goats were fed leucaena at 50% of the diet, symptoms similar to those in the previous experiment were observed (Dezin Soe Lwin 2014). In poultry, osteoporosis and bone ossification were observed with leucaena feeding (Khin Thida Win 2014), but there is little information on leucaena toxicosis on-farm.

Aung Aung (2007) developed and isolated a subspecies of *Klebsiella pneumoniae* from steers in Germany, which was transferred to sheep in Myanmar. Sheep inoculated with those microbes showed no clinical signs of leucaena toxicosis when fed a diet containing

50% leucaena. Moe Thida Htun (2012) conducted a study with sheep being fed gradually increasing amounts of leucaena leaves. For the first week, the sheep were fed leucaena at 10% of the diet and the level was increased by 10% each week until it reached 50% of the diet, which was thought to be a toxic level for sheep. However, the sheep showed no toxic symptoms and *Bacillus cereus* was isolated and identified from the rumen liquor of those sheep. The mimosine-degrading *Bacillus cereus* microbes were then transferred to goats (Dezin Soe Lwin 2014), which consumed a diet containing 50% leucaena without showing clinical symptoms of mimosine toxicity. In contrast, the control goats without inoculation continued to display toxic symptoms.

Niang Htun Aung et al. (2015) found that chicks showed leucaena toxicosis when fed a diet containing 6% leucaena but not after 21 days of age. Other reports suggest that chicks can tolerate 4–6% leucaena in the diet (NRC 1977) without developing symptoms of toxicity. It may be that at low levels of leucaena in the diet, toxic levels for chickens are not reached.

### Feeding of leucaena to animals in the field

Farmers in Myanmar have very limited knowledge of the benefits of feeding leucaena to animals. A case study in 10 townships from Yangon Region (75 farmers), Nay Pyi Taw Council (50 farmers) and Mandalay Region (125 farmers) in 2016 revealed that, while 80% were aware that leucaena could be used as animal feed, only 30.5% actually fed it to stock. There was wide variation between regions. In Yangon Region 65% of farmers rarely used leucaena as an animal feed. However, those in Nay Pyi Taw Council regularly fed leucaena to cattle and goats, collecting leucaena branches from the roadsides to feed their goats at home, often hanging the branches to minimize wastage. No information is available on amounts of leucaena offered to goats and cattle. Farmers consider that feeding leucaena reduces costs of production and also increases weight gains in ruminants and pigs.

In Mandalay Region, leucaena is abundant on roadsides and as fences for estates and cropping lands. Farmers allow cattle to graze communal lands, where leucaena grows, and consume leucaena. With the aid of the Australian Centre for International Agricultural Research (ACIAR), leucaena trees were provided to farmers to grow along fence lines of houses for feeding goats during the rainy season. Most farmers from Mandalay Region and Nay Pyi Taw area consider leucaena has potential to provide foliage for feeding animals in the dry season. There is a need to collect data

on the amount of leucaena being fed to the animals and on the effects of leucaena on daily liveweight gains of the animals, and any possible toxic side-effects.

Table 1 summarizes the knowledge situation of the farmers regarding leucaena and Figure 2 depicts collecting of leucaena foliage.

**Table 1.** Knowledge of farmers regarding leucaena feeding and toxicity in various regions of Myanmar.

Description	No. of farmers	Answer (%)		
		Yes	No	Unsure
Know that leucaena can be fed to stock	250	80.4	19.6	-
Actually feed leucaena	250	30.5	69.5	-
Know of leucaena toxicity	250	20.8	60.9	18.3
Want to plant leucaena	250	55.0	40.0	5.0



**Figure 1.** Farmers collecting leucaena to feed their animals.

## Conclusion

Information on the distribution and genetic diversity of leucaena in Myanmar is limited, but farmers indicate there is insufficient leucaena available for animal feeding. Further research is recommended to investigate why farmers in some areas rarely feed leucaena, so that extension programs to increase adoption can be mounted. Further programs to promote the establishment of leucaena plantations for feeding animals in close collaboration with rural communities in Myanmar are warranted.

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