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ETTAWAH CROSSBRED GOATS' PERFORMANCE



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1. INTRODUCTION

1.1. Background of the study

In Indonesia inadequate year-round feed supply is probably the most important factor contributing to low animal output. This constraint is not peculiar to Southeast Asia but is common in most tropical and subtropical countries. The supply of animal protein is commonly restricted by an insufficient supply of high-quality forage. Tropical grasses are generally low in quality and they do not sustain high levels of animal productivity. Their deficiencies lead to an increase in the time the animals take to reach marketable weight, resulting in the production of lower quality products (Palmer and Ibrahim, 1996).

Inadequate nutrition in ruminant animals has often been associated with heavy economic losses to the farmers because of animal weight and condition losses, reduction in reproductive capacity and increased mortality rates (Simbaya, 2001). The gap between the availability and requirement of energy (TDN) is not wide (21 %), but the deficiency of protein sources is critical (54 %) (Pradhan 1995). Further, the traditional protein sources available are used mainly for the feeding of dairy animals (cattle and buffalo). This has resulted in low productivity of small ruminants.

To obtain optimum production of sheep and goats, attention has been given to exploiting alternative protein sources (Singhi *et al.*, 2000). Commercial concentrates have been used as supplements to basal diets of goats. However, the cost of traditional concentrates are escalating due to low availability and high demand from non-ruminant livestock industries, which are also growing rapidly in Indonesia. Therefore, development of non-traditional feed resources to replace the commercial concentrate in the country is important.

In order to improve the productive and reproductive capacity of smallholder ruminant animals, there is a need to look at ways of producing these feeds on the farms. One potential way of increasing the feed supply under smallholder conditions may be through the use of fodder trees and shrub legumes (Simbaya, 2001). Tree legume forages supply relatively cheap sources of protein for livestock. Due to their high nitrogen content, they could be satisfactory substitutes for the more expensive protein supplements in ruminant feeds. Feeding tree legumes to cattle has resulted in increased intake and live weight gains

(Abdulrazak *et al.*, 2000). Advantages of using tree fodders such as *Calliandra calothyrsus* in Indonesia is its ready availability on farms (Devendra, 1988).

There is an abundance of feed materials from shrub and tree in tropical and sub tropical regions. Much of it is however under-utilised in ruminant feeding systems. The importance of these forages in animal feeding is due to their abundance, accessibility, protein content, protein quality, energy content, minerals and vitamins (Ramirez, 1997). The legume forages are becoming valuable in extensive (Kibria *et al.*, 1994) and crop livestock production systems which are important to goat production (Ramirez and Torez, 1997). However, some browse species may contain anti-nutritive factors that reduce intake and digestibility of nutrients such as protein (Reed, 1985) and may be toxic (Jones, 1979).

In Southeast Asia, shrub and tree legumes play an important role in providing fodder to ruminant animals. Shrubs and trees are not only sources of feed for animals in grazing and cut-and-carry systems but also provide fuel, fencing, shade, and enhance nutrient profile and soil stabilisation.

Leucaena leucocephala is one of the shrub legumes that has been widely promoted for use in tropical and subtropical environments because of its capacity for rapid regrowth following defoliation and its ability to produce large quantities of highly nutritious and highly palatable forage. Its use has led to sustenance of high daily live weight gains in animals without the use of expensive concentrate (Palmer and Ibrahim, 1996).

Unfortunately, most of the soils where smallholder farmers are found in Indonesia are infertile and acidic and not suitable for growing *Leucaena* unless considerable quantities of lime are applied. This problem of lack of adaptation and susceptibility to attack by the psyllid insect *Heteropsylla cubana* has negatively affected *Leucaena* adaptation in the smallholder sector of Indonesia. While it is reported that the incidence of psyllid infestation is declining, researchers are evaluating the potential of other shrubs that are resistant to this insect attack and can grow on the more acidic soils.

Calliandra calothyrsus has been identified as a candidate to complement or replace the cultivars of *L. leucocephala* presently in use (Palmer and Tatang, 1996). *C. calothyrsus* has been used in developing tropical countries under a cut-and carry system where *Leucaena*

has been devastated by the psyllid (Partridge, 1989). This shrub legume is receiving more attention in the tropical regions not only due to the problem of psyllid devastation in *Leucaena*, but also because it can grow in high rainfall areas and on acidic soils.

Calliandra calothyrsus is a versatile leguminous shrub or tree well known and widely used in Indonesia, because it is easy to cultivate and has multiple uses. More than 170 000 ha of eroded, poor or abandoned lands have been planted with *C. calothyrsus* in Java (Hermawan *et al.*, 1996).

The high production potential and high crude protein (CP) content of *Calliandra calothyrsus* makes it a ready source to cheaply satisfy ruminant protein requirements. However, *C. calothyrsus* contains secondary plant compounds (SPC) which may diminish its potential value as high quality feed. The most important SPC in *Calliandra* are tannins.

This study was set up to with the overall objective of evaluating the utilisation potential of *C. calothyrsus* as a protein supplement to Indonesian Ettawah crossbred goats.

1.2. Objectives of the study

The specific objectives of this study were:

1. To identify the possible active compounds in *C. calothyrsus* leaves.
2. To evaluate the nutritive value of *C. calothyrsus* including presence and level of tannins.
3. To evaluate the acceptability and intake of *C. calothyrsus* as a supplement to goats.
4. To evaluate the effect of supplementing Napier grass with *C. calothyrsus* leaves, coconut oil meal and maize meal on diet utilisation by goats.
5. To evaluate the effect of substitution of *C. calothyrsus* leaves for coconut oil meal and soybean cake waste on rumen fermentation and blood parameters of lactating goats.
6. To evaluate the effect of substitution of different levels of *C. calothyrsus* leaves for coconut oil meal and soybean waste cake on Indonesia Ettawah crossbred goats performance.

2. LITERATURE REVIEW

2.1. *Calliandra calothyrsus*

The genus of *C. calothyrsus* is native to North, Central and South America with two outlying species in continental Africa (Thulin *et al.*, 1981), nine named from Madagascar and two from the Indian subcontinent (Paul, 1979). In his recent revision of *Calliandra*, Barneby (1989) recognised 132 species from the Americas, assigned to five sections and 14 series. The centre of diversity within the genus is believed to be in the state of Bahia, Brazil, with a secondary centre of diversity in southern Mexico. Despite the genus's large size, *Calliandra* contains only a few species that are widely utilized. Some species are planted as garden ornamentals (e.g., *C. surinamensis* Benth and *C. haematocephala* Hassk.), but only one species, *C. calothyrsus* Meisn., has been widely cultivated and used within agroforestry systems.

The *Calliandra* species have particular relevance in the humid tropics and can be grown on acidic soils where other agroforestry trees perform poorly. It is primarily used outside its native range, in areas where high population density places pressure on limited land resources, and where agroforestry systems are being developed to maintain and sustain agricultural production (Chamberlain, 2001).

Although *C. calothyrsus* is rarely used in its centre of origin, it has been introduced to many tropical countries where it is used in agroforestry systems for the provision of fuelwood and shade, and as an intercrop hedgerow shrub to improve soil fertility and soil structure. More recently it has been used as livestock feed (NAS 1983; Lowry and Macklin 1989; Wiersum and Rika 1992; Palmer *et al.*, 1994). *Calliandra* is particularly favoured in Indonesia, where more than 170.000 ha have been planted for the reforestation of eroded rangelands. *C. calothyrsus* is widely commercialized in Indonesia and it was introduced into the region from Guatemala in 1936 (Baggio and Heuvelop, 1984).

2.1.1. Taxonomy

Genus : *Calliandra*
Family : *Leguminosa*
Subfamily : *Mimosoideae*
Tribe : *Ingeae*

Principal species : *Calliandra angustifolia*, *Calliandra calothyrsus* (syn. *C. confuse*), *Calliandra haematocephala* (syn. *C. inaequilatera*), *Calliandra houstoniana* (syn. *C. houstoni*, *C. houstonii*), *Calliandra pittieri*, *Calliandra portoricensis* (syn. *Zapoteca portoricensis*), *Calliandra surinamensis*, *Calliandra tetragola* (syn. *Zapoteca tetragonal*)

C. calothyrsus is also known as *Anneslia calothyrsus*, *Feuileea calothyrsa* Kuntze, *Calliandra confusa*, *Anneslia confusa*, *Calliandra similes*, *Anneslia similes*, *Anneslia acapulcensis*, and *Calliandra acapulcensis*.

The common names are Cabello de angel, Pelo del angel, cabellito, Barbe jolote, Barbe sol, Barbillo, Clavellino (Spanish); Kaliandra, Kaliandra merah (Indonesia), Calliandra (English).

2.1.2. Botanical Description

Calliandra is a multi-stemmed shrub and reaches a height of 4 – 6 m, but in favourable conditions it can reach a height of 10 – 12 m (Satjapradja and Sukandi, 1981). The leaves are divided into many straight leaflets and can reach up to 20 cm length and 15 cm width and they fold against the stem at night. The flowers are purplish red and mature over months. The pods take 2- 4 months to develop. At maturity the pods are about 14 cm long and 2 cm wide, are straight, medium brown and contain 8 – 12 ovules, which are up to 8 mm long.