

## Diversity of Availability of Feed Plant on Sub Optimal Land in Karangasem Regency, Bali



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### Abstract

The development of forage crops in Indonesia is directed at lands that are less productive for food crops, marginal land, and critical land, known as sub-optimal land. The research was carried out in Karangasem Regency: West Seraya, Seraya, and East Seraya Village which are Karangasem District, and Dukuh, Sukadana, and Tianyar Village, which are Kubu District. The number of respondents involved in this study were 20 farmers in each village, so the total number were 120 people. The data obtained were presented and analyzed descriptively. From the observations, it was found that the botanical composition of native pasture for the Seraya location found the presence of *Panicum maximum* grass that spreads on farmers' arable land and *rudera* areas. The types of shrub legumes used as hedgerows are *Gliricidia sepium*, *Leucaena leucocephala*, and *Calliandra calothyrsus*. The proportion of feed availability of shrub legumes, especially on hedgerows, is dominated by *G. sepium*. It can be concluded that the diversity of forage on sub optimal land is a potential in efforts to provide and fulfill bali cattle feed throughout the year, and the development of bali cattle and the availability of forage is dominated by shrub legumes, especially *G. sepium* and tree species.

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## 1 Introduction

Bali cattle (*Bos javanicus*) is one of the ruminant livestock which is the original Indonesian germplasm which is one of the leading commodities of the Province of Bali. Most of the bali cattle are raised conventionally because it is a people's livestock business. The development of bali cattle has a very strategic goal, starting from the preservation of germplasm until efforts to improve the welfare of the community. Efforts to develop of bali cattle farms are faced with various problems that greatly affect their productivity. The two main problems faced are the limited availability of good cattle breeds and the limited availability of feed, both forage and grain (Suarna et al., 2019). The development of forage crops in Indonesia is directed at lands that are less productive for food crops, marginal land, and critical land, known as sub-optimal land. Sub-optimal land is land that naturally has low productivity due to internal and external factors. Most of Indonesia's mainland land is sub-optimal land consisting of dry acid land, peat land, dry land with a dry climate, tidal swamp land, and lowland swamp land (Mulyani & Sarwani, 2013). Seraya and Kubu areas in Karangasem Regency are sub-optimal areas with a dry climate with a longer dry season than rainy season. The logical consequence of this condition is the limited availability of water which is one of the main growth factors for plants. However, these sub-optimal lands are the main supporting land for the development of ruminants, especially bali cattle. Kubu District, Karangsem Regency is an area with regosol soil type, most of which is critical to very critical land, which is 2658.99 ha with a peak dry season in the June-October period, as well as Seraya area with latosol soil type consisting of three villages are West Seraya, Seraya, and East Seraya, which is 20.47 ha is critical land. Nevertheless, Kubu and Seraya areas have a high carrying capacity for livestock populations, especially bali cattle. Land use in areas with a dry climate is mostly in the form of dry fields or mixed gardens, so that the type of forage given to bali cattle is relatively more diverse than rice fields. Types of forage plants are dominated by shrub or trees, both legumes and non-legumes, because these types can be used as hedgerows, intercrops, or shade plants. Nitis et al. (1994), reported that female bali cattle from the three strata system (STS) grew 80.57% higher during the rainy season, and 142.72% in the dry season compared to non-three strata (NTS). Budiasa (2015), stated that that the type and proportion of forage provided for bali cattle on different land uses and topography in Jembrana Regency, Bali is dominated by native pastures although the availability of crude protein nutrients on dry land mostly comes from the leaves of shrub or trees, especially *Gliricidia sepium*. The high population of bali cattle in Kubu and Seraya areas, where most of the land is sub-optimal land, with the conventional bali cattle rearing system is very interesting to explore, especially with regard to the diversity of forage availability and the proportion of feeding. Based on the above review, it is very important to conduct research on the diversity and availability of forage plants and their influence on the dynamics of the appearance of bali cattle in sub-optimal areas in Karangsem Regency, Bali Province (López-Bucio et al., 2003; Jetter & Cassady, 2006).

## 2 Materials and Methods

The research was carried out in Karangasem Regency, at West Seraya, Seraya, and East Seraya Village which are Karangasem District, and Dukuh, Sukadana, and West Tianyar Village, which are Kubu District. The research period conducted for 2 years, from October 2019 to October 2021. The research locations are villages which territory is included as sub-optimal land. The approach used is the climate of the village area. West Seraya, Seraya, and East Seraya Village are three of the 11 villages in Karangasem District that are included as sub-optimal land. Dukuh, Sukadana, and West Tianyar Village are the three villages chosen to represent Kubu Sub-district whose entire area is included in the sub-optimal land category. The number of respondents involved in this study were 20 farmers in each village, so the total number of respondents

involved in this study was 120 people. The data obtained were presented and analyzed descriptively (Rohwer, 2003; Magurran, 2021).

### 3 Results and Discussions

#### *Feed Source for Bali Cattle*

Sources of feed given to bali cattle that are kept by the community at both locations during the rainy and dry seasons are relatively the same (Kokou & Fountoulaki, 2018; Toso et al., 2009). During the rainy season at Seraya and Kubu locations, the source is from native pasture that grow under or between food crops, intercropping, and shade plants on dry fields and plantations, parts of land hedgerows, and agricultural waste. Meanwhile, in the dry season, besides being sourced from the part of the land owned by farmers, in Seraya a small portion of feed is also sought from outside of Seraya area, and in Kubu the source of feed is also dry grass which the local community calls “*sengauk*” (Table 1).

Table 1  
Sources of feed for bali cattle during rainy and dry seasons in Seraya and Kubu areas

Location	Rainy Season	Dry Season
Seraya	1. Native pasture	1. Native pasture
	2. Moor land and plantation	2. Moor land and plantation
	3. Land fence	3. Land fence
	4. Agriculture waste	4. Agriculture waste
	5. <i>Rudera</i>	5. <i>Rudera</i>
Kubu	1. Native pasture	1. Native pasture
	2. Moor land and plantation	2. Moor land and plantation
	3. Land fence	3. Land fence
	4. Agriculture waste	4. Agriculture waste
	5. <i>Rudera</i>	5. Dry grass
		6. <i>Rudera</i>

Bali cattle feed at the two research locations, Seraya and Kubu areas, was sourced from the land area owned or cultivated by each farmer. Native pastures grow and develop on the sidelines and under food crops, especially during the rainy season. Another source of pasture is from *rudera* lands, like empty land that is not used, such as along the shoulders or the edges of roads. Some of the grass also comes from several types of introduce grass, especially for locations in Seraya area. From the observations, it was found that the botanical composition of native pasture for Seraya location found the presence of introduce grass *Panicum maximum* that spreads on farmers' arable land and *rudera* areas. It is most likely that this grass has developed and spread naturally as a positive impact of the three strata system (STS) development program in 1988-1989. This is an effort to improve native pastures with introduce types of grass so that their quality can be increased (Aerts et al., 1999; Buxton, 1996).

#### *Variety of Bali Cattle Feed*

The type or variety of feed given to bali cattle in Seraya and Kubu areas during the rainy and dry seasons consisted of native pasture, and also introduce grass, that is elephant grass (*Pennisetum purpureum*). Besides elephant grass, there are also *Panicum maximum* grass and Setaria grass which are only found in the Seraya area in both the rainy and dry seasons (Underhill, 1994; Nilsson et al., 2019). The types of shrub legumes given to bali cattle are *G. sepium*, *L. leucocephala*, and *C. calothyrsus*. Meanwhile, non-legume tree species consist of *L. coromandelica*, *F. virens*, *H. tiliaceus*, *M. arborea*, and specifically for the Seraya location there is

also a *G. arborea* tree. In addition to forage types, the feed given is also in the form of agricultural waste and specifically at Kubu during the dry season the type of feed given to bali cattle is in the form of dry grass (“*sengauk*”) (Table 2).

Table 2  
Variety of forage and agricultural waste given to bali cattle at Seraya and Kubu areas during the rainy and dry seasons

Location	Rainy Season	Dry Season
Seraya	1. Native pasture	1. Native pasture
	2. <i>P. purpureum</i> , <i>P. maximum</i> , and <i>Setaria</i>	2. <i>P. purpureum</i> , <i>P. maximum</i> , and <i>Setaria</i>
	3. Shrub legumes: <i>G. sepium</i> , <i>L. leucocephala</i> , and <i>C. calothyrsus</i>	3. Shrub legumes: <i>G. sepium</i> , <i>L. leucocephala</i> , and <i>C. calothyrsus</i>
	4. Tress: <i>L. coromandelica</i> , <i>F. virens</i> , <i>G. arborea</i> , <i>H. tiliaceus</i> , <i>M. arborea</i>	4. Tress: <i>Lannea coromandelica</i> , <i>F. virens</i> , <i>G. arborea</i> , <i>H. tiliaceus</i> , <i>M. arborea</i>
	5. Agriculture waste	5. Agriculture waste
Kubu	1. Native pasture	1. Native pasture
	2. <i>P. purpureum</i>	2. <i>P. purpureum</i>
	3. Shrub legumes: <i>G. sepium</i> , <i>L. leucocephala</i> , and <i>C. calothyrsus</i>	3. Shrub legumes: <i>G. sepium</i> , <i>L. leucocephala</i> , and <i>C. calothyrsus</i>
	4. Tress: <i>L. coromandelica</i> , <i>F. virens</i> , <i>H. tiliaceus</i> , <i>M. arborea</i>	4. Tress: <i>L. coromandelica</i> , <i>F. virens</i> , <i>H. tiliaceus</i> , <i>M. arborea</i>
	5. Agriculture waste	5. Agriculture waste
		6. Dry grass (“ <i>Sengauk</i> ”)

Sources of forage other than grass mainly from the area around the land that functions as a fence, intercropping, and shade plants planted in the middle of the land. Other sources of feed besides forage are agricultural waste. Agricultural waste used are corn straw, cassava, sweet potato, types of nuts especially peanuts, and banana stem. Forage production in the form of legumes mainly comes from the fence section of the land. The types of shrub legumes used as hedgerows are *G. sepium*, *L. leucocephala*, and *C. calothyrsus*. This type of legume has good quality with high protein content and very palatable as feed for bali cattle. The proportion of *G. sepium* in the fence at Seraya is 75% and Kubu is 74%, but its use as feed with other shrub species during the rainy season in Seraya and Kubu areas was only 7.6% and 3.9% for pregnant cows, and 9.75% and 5.5% for fattening bali cattle. The use of shrub legumes with quite high is only given during the dry season, which is 30.4% to 35.8%, also accompanied by the provision of forage from non-legume trees, which is 29.3% to 33.1%. The above conditions are in accordance with the forage feeding system in the three strata system (STS) (Suriani & Darmadi, 2019; Zambrano et al., 2019).

#### *Pasture Growing Space, Types and Proportions of Forage Plants*

Native pasture grows on farmers' land areas, on rice fields as well as under or between main crops and open spaces that are not used specifically, such as roadside, known as *rudera*. The growing space for native pasture on paddy fields is 3.42%, while the growing space for dry land/mixed gardens at Seraya is 24.2% and Kubu is 26.5%. Meanwhile, on *rudera* land, the growing space for native pasture is 100%. The presence of forage plants of shrubs and trees that are planted as intercrops or shade plants are relatively few and not patterned. Most of the forage plants are shrubs and trees that are planted and functioned as hedgerows that can be harvested and given to bali cattle. The highest proportion is the type of *G. sepium*, which is 75.1% at Seraya and 73.6% at Kubu. The second proportion at Seraya is *H. tiliaceus*, which is 6.5%, while Kubu is *M. arborea*

which is 5.6%, while *M. arborea* are used as hedgerows at Seraya. Other types of forage plants are *L. leucocephala*, *C. calothyrsus*, *L. coromandelica*, and *F. virens* with a proportion of 3.1 -5.6% (Figure 1).

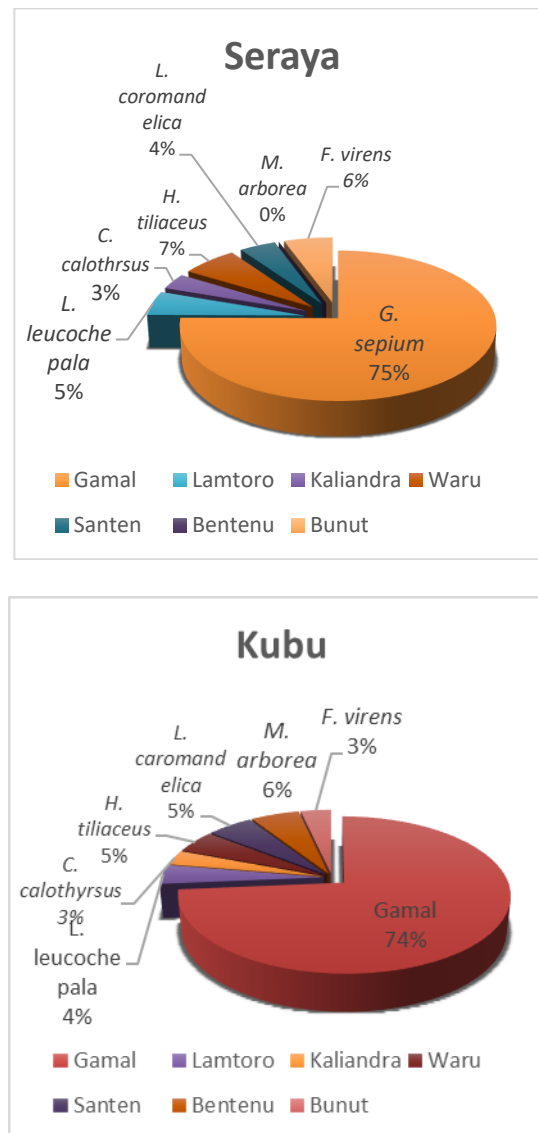


Figure 1. Types and proportions of forage plants on the fence

The proportion of feed availability for shrub legumes, especially on hedgerows, is dominated by *Gliricidia sepium*. This is because *G. sepium* is very easy to grow, has high production and quality, and is relatively free and resistant to pests and diseases. Another advantage is that vegetative *Gliricidia sepium* plants can still produce until the middle of the dry season, and if proper cutting is done they can continue to produce until the end of the dry season. The availability of *G. sepium*, *L. leucocephala*, and *C. calothyrsus* in sufficient quantities as forage is a very positive thing for the performance of bali cattle. Sutardi (1993), stated that *Gliricidia sepium* acts as a source of degradable protein intake (DIP). Putra (1999), stated that the provision of forage based on leguminous can improve the performance of bali cattle. Pond et al. (1994), stated that leguminous plants can be used as a quality feed source because of their high protein (15-26%), low cell wall (NDF) 20-45%, and high in vitro dry matter digestibility (50-68%). The proportion of forage given to pregnant and fattening bali cattle

at Seraya and Kubu in the rainy season consisted of mostly pasture, in the range of 68.3-77.4%, which is very logical because the availability of pasture in the rainy season is very high, and if not utilized maximally, pasture will dry soon. That proportion gave opportunities for the use of other types of forage and agricultural waste. This is not only to fulfill the amount of feed for consumption but at the same time to improve the quality of feed given to Bali cattle. The opposite condition occurs in the dry season where the proportion of forage from shrub legumes and tree given to livestock is very high. This proportion will be better in quality than the proportion of forage given during the rainy season. From the results of the study, it was found that there was an increase in body weight gain which tended to be higher during the dry season. However, another factor that needs to be considered for this assumption is the impact of environmental stress e. g. temperature in the dry season period which can directly or indirectly affect the condition of livestock.

## 4 Conclusion

Based on the results of research and discussion, it can be concluded as follows:

- Diversity of forage on sub optimal land is a potential in efforts to provide and fulfill Bali cattle feed throughout the year, and one of the main supporting factors in developing Bali cattle on sub optimal land

Availability of forage is dominated by types of legumes, shrub, especially *Gliricidia sepium*, and tree species which are the main forage types for Bali cattle according to their natural habitat in the wild.





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