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HERBAGE YIELD AND QUALITY OF TWO GRAZING AREAS IN PALU VALLEY OF CENTRAL SULAWESI

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ABSTRACT

This study, carried out using a 'destructive-sampling' method, was aimed at investigating forage production and quality of two grazing areas (Kawatuna dan Poboya) in Palu Valley, Central Sulawesi. Samples of herbaceous plant cover from the two areas were harvested using a pair of 1 m^2 quadrants placed randomly at 10 m interval on two parallel transects (20 m apart). The harvested samples were identified and grouped into grasses, legume and weeds, and the grass and legume samples were subjected to dry matter (DM) and nitrogen (N) analyses. Results of this study showed that the two studied grazing areas were thinly and poorly covered by vegetation, and bare spaces were obvious in some places. The herbaceous plant cover in the Kawatuna was composed of 41.8 % grasses, 24.3 % legumes and 33.9 % weeds while the corresponding composition in the Poboya was 52.3, 13.7 and 34 %. The DM yield (kg/ha) for the total herbaceous vegetation was 434.6 (Kawatuna) and 568.8 (Poboya), while that for forage component was 287.3 (Kawatuna) and 375.5 (Poboya). The N contents (g/100g DM) ranged from 5.1 to 6.2 for forage grasses and from 8.4 to 9.3 for forage legumes. The estimated carrying capacity was 2.0 ha and 1.5 ha per-head of sheep for the Kawatuna and Poboya, respectively. The two grazing areas were dominated by *Cynodon sp.* and *Digitaria fuscescens* grasses. The dominant forage legumes in the Kawatuna were *Tephrosia sp., Desmodium triflorum* and *Alysicarpus sp.*. While these species were also found in the Poboya, the primary legume in the latter site was *Tephrosia sp.*. *Lantana camara* was the dominant shrubby weed found in the Kawatuna, followed by 'milkweed' (*Caltropis sp.*), *Jatropha curcas*, and *Opuntia monacantha*. These shrubby weeds were also observed in the Poboya, but clumpy-grass of *Sporobolus sp.* was more dominant in this site.

Keywords:Forage Production, Botanical Composition, Carrying Capacity, Kawatuna, Poboya, Palu Valley.

INTRODUCTION

The region of Palu Valley in Central Sulawesi is characterized by its dry-climate, having only about 600 mm of mean annual rainfall during the period of 1987-2006. Amar dan Tarsono (2003) recorded two wet months (March-April) only in 1999 and a total rainfall of 644 mm for 99 rainy days in that year. Despite this limited rainfall rates, the region has long been known to play an important role in sheep production.

The majority of sheep population in this area is composed of Donggala fat-tailed sheep, an indigenous local breed. However, crossbred between the local sheep and

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Merbas (Merino x Gibas) also contributes to this population. The latter breed was introduced into the area by government in 1986 with an intention to increase the performances of the local breed. These two sheep breeds are kept in a grazing-based production system by their owners on the available communal grazing fields. In this system, the animals are generally released in the morning to graze during most of the day and then returned in the afternoon to their confinements. Feed supplements are rarely provided and the animals are thus highly dependent on feed available on the grazing lands. The production of the animals in this region is thus relatively low. In a field experiment, for example, Amar *et al.* (2005) reported that under the production system applied by the animal owners, the animals gained weight at rates of between 62.5-70.8 g per day, which increased slightly to 70.0-82.1 g when the animals were supplemented with 250 g rice bran per day.

From the fact that the lands have been used as the primary source of feeds for the sheep population, it is estimated that there has been a substantial nutrients removal from the lands by the grazing animals. Attempts to sustain the availability of nutrients on the fields, for example through the use of legume or fertilization by which parts of the removed nutrients may be returned to the fields have not been made. The observed low rate of animal production may indicate that the quantities and qualities of feed available on the grazing lands have been decreasing to states below those are required by the grazing animals to grow optimally.

This field experiment was intended to study the production and quality of forages available in the two of the grazing fields in Palu Valley, i.e. Kawatuna and Poboya. Such study has not been done in the past and information generated is expected to provide foundation for management of native grazing lands in this area.

MATERIALS AND METHODS

Two grazing sites were chosen for this study, that was one each, at Kawatuna Village in the Sub-district of South Palu, and at Poboya Village in the Sub-district of East Palu. These rangelands cover a respective area of about 430 ha in the Kawatuna and 600 ha in the Poboya. Botanical composition and production from these two sites were determined by a destructive-sampling method (Mannetje and Haydock, 1963; Tothill *et al.* 1992) using a pair of 1 m^2 quadrants placed randomly at 10 m interval on two parallel transects at 20 m apart. All herbaceous plants in a quadrant were cut at the ground level and collected. Soil samples were also collected from top-soil of 10 x 10 x 10 cm, after freeing them from plant debris, animal manure and gravel, at interval one out of ten quadrant placements on each transect.

One hundred and nineteen and 110 herbage samples were respectively taken from the Kawatuna and Poboya sites. Later, each of the field herbage samples was sorted into groups of forage legumes, forage grasses, or weeds, which was then dried to a constant weight in a forced-draught oven at 70°C for estimating the dry herbage production. Nitrogen content of the herbage legumes and grasses were also determined using a standard procedure. Soil samples were analysed for general soil attributes.

Due to the very thin and sparse ground covers at both sites, 25% proper-used factor was applied to calculate forage availability. A light grazing intensity was assumed in determining the grazing capacities of the rangelands, with an assumption of

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60 days rest following 30 days grazing according to the Voisin formula (Reksohadiprodjo, 1981).

RESULTS AND DISCUSSION

The two grazing lands observed in this study were poorly covered by vegetation and some bare spaces were obvious. The soil of the two sites were characterised as sandy loam in texture and a pH (H_2O, 1:2.5) range of 5.5 – 6.6. The soils contained 2.25 – 2.56% total organic carbon, 0.25 – 0.31% total nitrogen and 33.5 – 49.8 ppm P_2O_5 (Bray-1) available phosphor.

The major components of herbage harvested from both sites were grasses while legumes were the least component (Table 1). *Cynodon sp.* and *Digitaria fuscescens* were identified as the dominant forage grasses irrespective of the site. At the Kawatuna, the major forage legumes were *Tephrosia sp., Desmodium triflorum* and *Alysicarpus sp.* These legume species were also found at the Poboya, but the site was dominated more by *Tephrosia sp.*

About 34 percent of the collected herbage samples from both sites were composed of weeds (Table 1), but each site was dominated by different weed species.

Table 1. Botanical composition and nitrogen contents of the forage components from the two-study sites.

Sites	Botanical composition (% dry-matter of cut sample)			Nitrogen content (% dry-matter, n = 2)	
	Grasses	Legumes	Weeds	Grass	Legume
1) Kawatuna	41.8	24.3	33.9	0.82	1.49
2) Poboya	52.3	13.7	34.0	0.99	1.34

For botanical composition: 1) n = 119, and 2) n = 110

Table 2. Total dry-matter production of the forage component, and carrying capacities of the studied areas (calculated from 110 quadrant cut samples).

Sites	Forage DM-yield (kg/ha, legume + grass)	Carrying capacity (ha/head sheep of 35 kg body wt.)
1) Kawatuna	287,3	2.0
2) Poboya	375,5	1.5

At the Kawatuna, the shrub of *Lantana camara* was the dominant weed species, followed by the 'milkweed' (*Caltropis sp.*), *Jatropha curcas* and *Opuntia monacantha.* The last three shrub weeds also observed at the Poboya, but the most dominant weed species in this site was the herbaceous clump-grass of *Sporobolus sp.* Other herbaceous weedy species identified at both sites were *Oxalis barrelievi, Polygola chinensia* and *Torenia violancea.*

Data on botanical composition and nitrogen concentration of the forage components (Table 1) suggest that the grazing lands of Kawatuna and Poboya are of low nutritional quality. The proportion of weed component which is of low nutritional significance to animals was relatively high, while the nitrogen contents of both grasses and legumes were low. The respective mean nitrogen content (% dry matter) of 0.91 and 1.42 for grasses and legumes were lower than the minimum nitrogen concentration of 1.8 required by ruminants (Little, 1980). These nitrogen contents were also lower than

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those reported by others for the same grasses or legumes species. For example, Skerman and Riveros (1990) quoting others reported the nitrogen contents of 1.04-2.24 % for *Cynodon spp.* and *Digitaria spp.* grasses while Skerman *et al.* (1988) the nitrogen contents of 2.04-2.60 % for *Desmodium spp.* and *Alysicarpus spp* legumes.

Apart from the low nutritional quality of the available forages, the quantity of forage that may be available to grazing animals seemed to be also limited. The low rainfall rates in the areas and continuing removals of nutrients from the soil appeared to have affected the soil fertility and growth of vegetation. Such phenomena occur in other parts of the world, for example in semiarid regions of Western Africa (Bationo and Mokwunye, 1991), in the United State of America (Buxton, 1989), and in Asia (Singh, 1994) including in Indonesia in such areas as this region of Central Sulawesi, East and West Nusa Tenggara. The poor conditions of the native grazing lands now reported are indicated by the low forage dry matter production and carrying capacity of the grazing lands (Tabel 2). In communal grazing systems, however, it is difficult to control the number of animals grazing the fields and, as a consequence, overgrazing is easy to occur. Under such grazing field conditions, the grazing animals will need to explore larger grazing areas to meet their dietary requirements which result in more of the absorbed dietary energy being directed for grazing activities than used for productive purposes. One approach that may be attempted to recover the degraded native grazing lands such as reported in this study and to support a grazing-based animal production system in more sustainable ways is through the use of introduced leguminous plants with high productivity and nitrogen contents. Legumes are able to satisfy their needs for nitrogen by capturing it from the atmosphere and they are, therefore, less dependent on the provision of external nitrogen inputs. Also, the legumes do not only directly provide high quality nutrients to the grazing animals, but also will in the long term increase the soil fertility, particularly the nitrogen and organic matter contents of the soil. The use of legumes will eventually increase the availability of forage and thus improve productivity of the grazing livestock (Jones *et al.* 1984; Winter *et al.*, 1989; Shelton, 1990). This approach can be initially done by selecting and improving the native legume species already adapted to the local environments and or introducing new adapted legume genotypes (Amar, 2000; Amar and Tarsono, 2003). The climatic conditions and species adaptability to such conditions are probably among factors that need to be taken first into consideration when selecting the legumes species for this purpose.

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