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Potential of Weed As Raw Material for Animal Feed on The Integration of Cattle with Coconut Plantations

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Abstract: Constraints on the use of forage for animal feed in smallholder coconut plantations are product availability and chemical composition of nutrients that are lacking and their production potential is low. The reason for this is that the soil under the shade of coconut is not managed intensively. The aim of the study was to evaluate the management of coconut shaded soils based on their ability to increase the potential of forage products and their capacity for raising cattle. The results showed that the production of forage products as raw material for animal feed was the best obtained in the system of planting patterns of sweet corn-long beans-fallow and long beans-sweet corn-fallow. The cropping pattern found 5 species of weeds in the Poaceae family, 4 species of broadleaf weeds and 2 species of puzzles with a palatable level in the category of favored to very favored with an inedible weight percentage of 75.431–98.732%. The Poaceae weed family gave the highest contribution to the total forage production per hectare, which was 8.72 kw ha^{-1} day^{-1}. While the lowest of broadleaf weeds and puzzles in the system of long bean-sawley-fallow cropping pattern was 1.22 kw ha^{-1} day^{-1} and the mustard-longbean-fallow cropping pattern was 1.31 kw ha^{-1} day^{-1}. The carrying capacity of coconut shaded soil for raising cattle, before being managed was 0.83 ST ha^{-1}-1.52 ST ha^{-1}, after being managed it increased significantly, especially in the sweet corn-longbean-fallow and longbean cropping system. - fallow sweet corn to 2.612 ST ha^{-1} – 3.87 ST ha^{-1}.

Keywords: Forage; Weeds; Palatable; Animal feed; Coconut

Introduction

Weed control by using it as animal feed is still limited to certain types of weeds, during the rainy season and/or when there are plants. Meanwhile, during the dry season, farmers have difficulty providing animal feed. This of course has implications for unstable livestock and meat production. One of the appropriate actions to overcome these problems is to utilize a system of reciprocal relationships between plants and livestock (Crop and life stock animals relations) through a consistent increase in the population of ruminants such as cattle (Abdullah, 2010). The consequence of an increase in the livestock population, of course, must be balanced with an improvement in the supply of forage for feed (Ngawit et al, 2013; Ngawit et al, 2017).

Weed management which emphasizes the use of it as a raw material for animal feed for several important weed cases in Indonesia has been successful. For example, the water hyacinth weed (*Monochoria cracipes* L.), which is an important and very difficult weed to control, and causes problems in almost all Indonesian waters, can now be managed properly. The water hyacinth weed is not eradicated anymore but is used as a raw material for the handicraft industry, animal feed, growing media for mushroom cultivation and compost (Ngawit et al., 2017).

In line with this analogy, the problem of weeds in the soil under the canopy of coconuts, which are dominated by Poaceae species, needs to be managed based on the principle of benefit, although it must be adapted to local specific environmental conditions. Bearing in mind, the character of the agro-ecosystem of coconut plantations in Indonesia is in two types, namely lowland and medium plains. Coconut growth in the medium plains is generally more fertile than in the

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lowlands. Likewise the cover vegetation in the medium plains coconut groves, generally dominated by shade tolerant species.

The opportunity for weeds and forages to increase the availability of feed in coconut shaded soil ecosystems is much better compared to oil palm, rubber and coffee plantation ecosystems because high levels of light intensity are available for quite a long time (Stür, 1990; Chen, 1990). At the beginning of coconut growth, the available light intensity is high (> 80%) and decreases to < 50% at the age of 5-10 years which then increases again in line with the height of the coconut plant with a light intensity level of 60-80%. With a relatively long productive period (75 years), the level of light intensity in coconut plantations is still very supportive for the growth of various types of forage with high yield potential. A mixture of various types of forage with high yield potential such as *Panicum*, *Brachiaria* (poaceae) and *Stylosanthes*, *Centrosema*, *Calopogonium*, *Pueraria* (legumes) with forage species that are tolerant to shade such as *Desmodium*, *Arachis* (legumes) as well as *Stenotaphrum*, *Axonopus*, *Paspalum conjugatum*, *Paspalum notatum* (poaceae) can be planted in coconut plantations (Mantiquilla et al., 2000).

Forage development in this ecosystem can be carried out through oversowing with shade-tolerant legume species (such as *Calopogonium*, *Centrosema* (Horne and Stur, 1999). Ngawit et al. (2003), reported that weeds in alley cultivation systems (Allay) cropping) between annual crops and seasonal fruit and vegetable crops, has been used as animal feed but is still limited to several types of poaceae weeds such as *Cynodon dactylon*, *Eulusin indica*, *Phaspalum conjungtum* and *Axonopus compressus*. Meanwhile other types of weeds, especially from the utilization of broadleaf and other forage products is still very lacking.Business of raising cattle, especially Bali cattle, farmers prioritize their feed from grass-type weeds, agricultural wastes and other forage products from generation to generation, without the application of good feed management and maintenance (Asih , 2004). As a result, the feed dose given to men so it is not controlled, during the rainy season or when forage products are abundant. However, when the dry season arrives, farmers provide livestock feed at modest doses, without taking into account the nutritional content, especially carbohydrates, protein, minerals and vitamins (Ifar and Bambang, 2002). Nitis et al. (1990), explained that the dosage of feed nutrients greatly determines the shape of the growth chart for cattle, in this case, if the feed dose is high, the growth rate will be high and the livestock will reach specific weight at a young age.

The lack of utilization of weeds from broadleaf and other forage groups is due to limited information regarding the potential of these weeds, especially their palatable level, botanical composition and chemical nutritional content. Therefore, a study was carried out with the aim of identifying and describing the characteristics of weeds that have the potential to be used as raw materials for animal feed based on dry biomass weight, botanical composition, chemical nutritional content and their potential to supply forage products. It is hoped that weed species can be found that have the potential to be used as raw material for livestock manure, so that the capacity to accommodate coconut plantations for raising cattle can be determined.

Method

Descriptive research with direct observation in the field has been carried out to observe the dominant weeds that have the potential to be raw materials for animal feed in coconut shaded soil. Observations were made in two different types of coconut plantation agro-ecosystem locations, namely the shaded soil agro-ecosystem type which is managed more intensively, because it is often planted with corn and legumes located in Santong Village, Kayangan, North Lombok, and the agro-ecosystem which is less intensively managed due to limited irrigation facilities in Mumbul Sari Village, Bayan District, North Lombok, NTB. The research was conducted for 6 months, from March to September 2022. The sampling points for the observations were determined as many as 3 smallholder coconut plantation areas for each type of agroecosystem. The observation method used is census square. The number and area of the observation sample plots was determined based on the area curve method for species diversity (Species area curve), while the distribution of the observation sample plots was carried out randomly, using the regular sampling method (Ngawit, 2005). Based on this method, 12 sample plots were determined for coconut shaded soil areas which were managed more intensively and 15 sample plots for less intensively managed shaded soil areas with an area of 1 m^2 for each sample plot.

Attempts to obtain quantitative and qualitative data on weeds were carried out by analyzing the vegetation by identifying the types of weeds found in each sample plot according to the USDA method, and Biotrop (2008), involving several variables such as density, frequency and dominance which have been used as standard measures. Observations in the quadratic method were carried out destructively by cutting weeds right at the soil surface to observe the population of each type and the weight of their biomass (Taufan et al., 2014). Furthermore, quantitative calculations were carried out according to the method of Dekker (1979), to calculate the important value index (IVI) and SDR (some dominance ratio). Predicting the potential of weeds as forage products as a source of animal feed was carried out by observing morphological

characteristics, botanical composition, dry biomass weight, chemical composition of nutrients and forage production per hectare, as well as the palatable level of each weed type.

The prediction of forage production per hectare is determined using the following formula (Taufan et al., 2014):

$$P = C \times 10.000 - (LP \times JS) \quad (1)$$

Description:
P = forage production per hectare (kg)
C = average forage weight per m^2
LP = area of coconut disc/boil per hectare
JS = number of coconut trees per hectare

The production of forage between plants in question is the production of dry weight, namely fresh forage which has been dried in an open manner at 60 ^oC for 48 hours and the weight is constant.

The botanical composition of weeds was determined based on the ratio of the dry weight of one plant species to the total dry weight of all plants in each sample plot/snippet, then compared to all sample plots. Sampling was carried out before calculating the production of dry weight. The chemical composition of weeds and other forage nutrients in the two types of coconut plantation agro-ecosystems was analyzed proximately to obtain protein, fat, carbohydrates, crude fiber and ash content. Prosimate analysis was carried out at the Laboratory of Animal Nutrition, Faculty of Animal Husbandry, University of Mataram.

To determine the capacity of a coconut plantation for raising cattle, the formula is used according to (Taufan et al., 2014):

$$(Y - 1)s = r \quad (2)$$

Description:
Y = The area of land required by one unit of cattle (ST), which is equivalent to one bull weighing 400 kg.
s = The period of grazing on each land area or the long period of raising livestock on each land area that is able to provide forage.
r = The period of forage growth process capable of producing feed during the livestock rearing period. It can also be determined that s = 30 days; r = 60 days; PUF (Proper use factur) = 40 %; and consumption of fresh forage is assumed to be 10% of each livestock unit.

The preference level of cows for various types of weeds and forage as feed (palatable) is determined by the score, based on the amount of forage eaten by livestock. The score and preference level of cattle for the feed provided is presented in Table 1 below (Laksmi Ernawati et al., 2014):

Table 1. The score and preference level of cattle (palatable) for forage

Score value	Percentage of forage preparations eaten (%)	Livestock preference level (Palatabel)
8	90 – 100 %	Really like it
7	80 – 90 %	Really like
6	70 - 80 %	Love it
5	60 – 70 %	Like
4	50 - 60 %	Enough like
3	40 – 50 %	Do not like it much
2	30 - 40 %	Do not like
1	< 30 %	Very dislike

Result and Discussion

Population Structure of Weeds in Smallholder Coconut Plantations

At both study locations there were differences in weed population structure based on the number of family groups and their morphological structure. Based on the morphological structure, weeds are grouped into narrow-leaved (Poaceae), puzzles (Ceperceae), broad-leaved (broadleaf weed) and soft weed (soft weed). Weed populations in intensively managed smallholder coconut plantations have less diversity than in non-intensively managed coconut plantations. In intensively managed plantations, five dominant species were found from the Poaceae family, such as *Ottochloa nodosa*, *Axonopus compressus*, *Paspalum spp*., *Digitaria spp*., and *Panicum repens*, two dominant species from the sedge group and six the dominant species in the broadleaf group, namely *Calopogonium caeruleum*, *Desmodium scalpe*, *Mucaena pruriens*, *Mimossa pudika*, *Hytis captata*, *Asystasia intrusa*, and *Crotalaria striata*.

Whereas in plantations that were not managed intensively, ten species were found from the Poaceae family, namely *Eupatorium odoratum*, *Eupatorium riparium*, *Eupatorium nigra*, *Panicum repens*, *Saccharum spontaneum*, *Imperata cylindrica*, *Cynodon datylon*, *Eragrotis nigra*, *Digitaria spp*., and *Paspalum conjugatum* . Two species of puzzles, namely *C. rotundus* and *C. irria*. Eight broadleaf species and three chronic broadleaf weeds with shrub characters such as *Lantana camara*, *Clorataria striata*, and *Berreria spp*. (Figure 1).

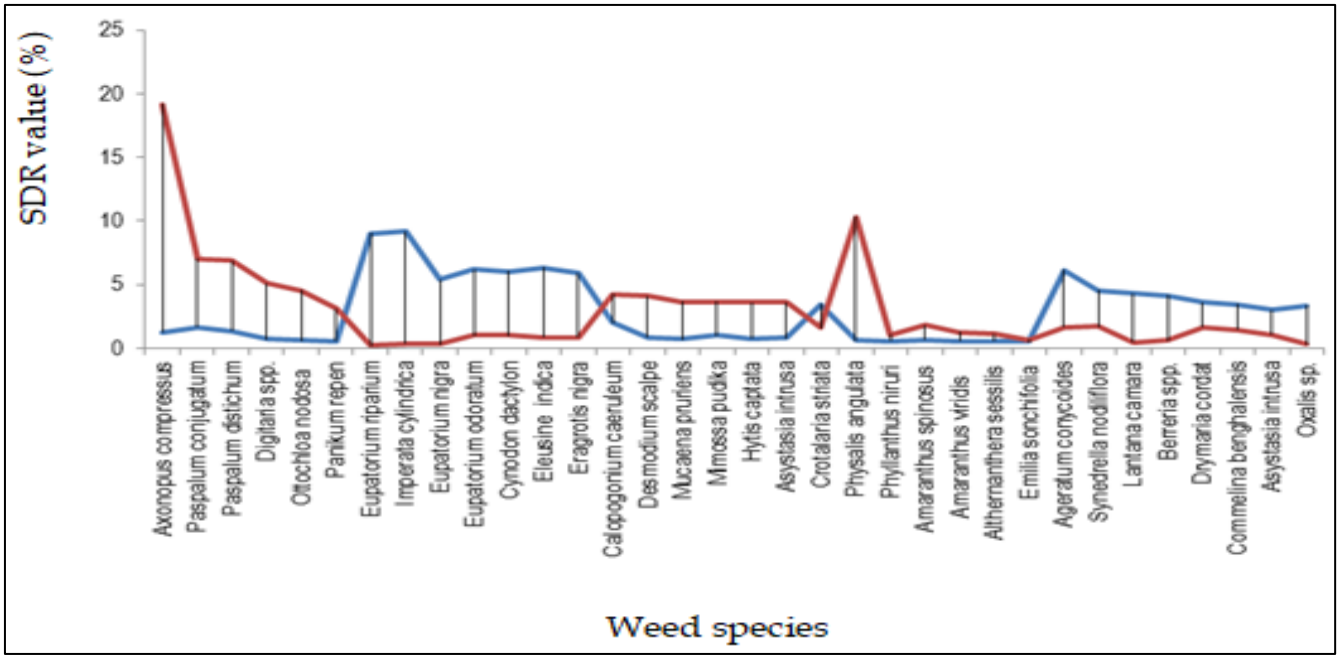

Figure 1. Weed population structure and dominant species expressed by SDR values in intensively managed coconut plantations (red) and those that are not managed intensively (blue)

The data in Table 2 shows that weed populations have different characters, especially in intensively managed plantation locations, dominated by annual and broadleaf weeds, while in plantations that are not intensively managed, where the flowering and drought periods are longer, it is dominated by annual weeds. more vicious and difficult to control. The condition of the land which is often abandoned without any plants in this plantation area causes several types of chronic weeds to grow dominantly with a low biomass weight contribution. As a result, the average weed biomass weight obtained in plantations that were not managed intensively was only 6.37 $g.m^{-2}$ which was lower than that in plantation areas that were intensively managed as much as 9.43 $g.m^{-2}$. Weed communities in intensively managed plantations are more fertile with larger, longer and wider stem, branch and leaf morphological structures.

Conversely, weeds whose growth is stunted due to drought stress, nutrient deficiency and lack of sunlight, will shorten their life cycle by reducing the vegetative growth phase and accelerating the generative phase, so that the size of the weed performance becomes smaller (Ngawit, 2005). In addition, in plantation areas that are managed intensively, the closing of the plant canopy throughout the year means that only weeds that can withstand low light intensity can survive to grow. For example, *Ottochloa nodosa*, *Axonopus compressus*, *Polygonium nepalense*, *Oxalis spp*, *Commelina benghalensis*, *Cynodon dactylon*, and *Drymaria corda* (*Poaceae*).

In conditions of fertile soil environment, the weight of this type of weed biomass is higher when compared to other types of annual weeds. Differences in coconut shaded soil management systems due to limited irrigation, which has implications for low planting intensity, also affects the structure and species composition of weeds that grow. This of course further reinforces previous allegations that on soils that are infertile and often experience drought, the dominant and very permanent and typical weed species growing in the region are: *Panikum repans*, *Eupotarium riparium*, *Saccharum spontaneum*, *Lantana camara*, *Eleusine indica*, *Clorataria. striata*, *Berreria spp*., and *Imperata cylindrica*.

Botanical Composition and Chemical Content of Weed Nutrition

The data in Figure 2 shows that Axonopus compressus, Paspalum conjugatum, Paspalum distichum, Digitaria spp., Ottochloa nodosa, and Panikum repen have a higher proportion of botanicals in intensively managed coconut plantations. Because in this location the growth of coconuts is better so that the canopy of the coconut plants shade the soil in the stand area more than in plantation locations that are not managed intensively. This shows that some of the Poaceae weed species are more shade tolerant than other Poaceae weeds such as Panicum repens., Imperata cylindrica, Cynodon datylon, Eragrotis nigra, and Paspalum conjugatum, which have a larger proportion of botanicals in coconut plantations that are not managed intensively.

Table 2. Comparison of weed species populations expressed by important value index (IVI), SDR, and dry weight of biomass in two types of smallholder coconut plantation agroecosystems

Weed Species	Plantations that are not managed intensively			Intensively managed plantations		
	IVI (%)	SDR (%)	Dry biomass (g.m^{-2})	IVI (%)	SDR (%)	Dry biomass (g.m^{-2})
Axonopus compressus	2.49	1.245	3.31	38.37	19.2	28.62
Paspalum conjugatum	3.36	1.680	4.12	14.03	7.02	26.04
Paspalum distichum	2.73	1.365	3.02	13.76	6.88	22.22
Digitaria spp.	1.49	0.745	1.24	10.24	5.12	20.32
Ottochloa nodosa	1.22	0.610	1.40	9.12	4.56	24.74
Panikum repen	1.12	0.560	1.24	6.10	3.10	18.20
Eupatorium riparium	18.04	9.020	22.13	0.39	0.20	2.22
Imperata cylindrica	18.39	9.195	14.33	0.76	0.38	2.42
Eupatorium nigra	10.77	5.385	13.42	0.68	0.34	3.38
Eupatorium odoratum	12.35	6.175	13.33	1.80	1.00	2.54
Cynodon dactylon	12.09	6.045	12.82	1.80	1.00	3.51
Eleusine indica	12.71	6.355	12.62	1.73	0.87	2.43
Eragrotis nigra	11.76	5.880	12.21	1.70	0.85	2.34
Calopogonium caeruleum	4.03	2.015	3.64	8.46	4.23	19.52
Desmodium scalpe	1.76	0.880	2.12	8.20	4.10	18.50
Mucaena pruriens	1.46	0.730	2.10	7.36	3.68	12.48
Mimossa pudika	2.01	1.005	2.82	7.30	3.65	15.44
Hytis captata	1.55	0.775	2.61	7.25	3.63	15.10
Asystasia intrusa	1.63	0.815	2.64	7.20	3.60	15.10
Crotalaria striata	6.9	3.450	5.54	3.22	1.61	14.62
Physalis angulata	1.27	0.635	1.02	20.56	10.3	16.24
Phyllanthus niruri	1.12	0.560	1.10	2.12	1.06	3.12
Amaranthus spinosus	1.3	0.650	1.15	3.66	1.83	1.14
Amaranthus viridis	1.12	0.560	1.06	2.56	1.28	1.01
Althernanthera sessilis	1.12	0.560	1.05	2.22	1.11	2.22
Emilia sonchifolia	1.00	0.500	1.00	1.36	0.68	1.10
Ageratum conycoides	12.3	6.150	13.42	3.33	1.67	2.04
Synedrella nodiliflora	9.12	4.560	10.48	3.46	1.73	2.21
Lantana camara	8.6	4.300	10.12	0.96	0.48	1.02
Berreria spp.	8.3	4.150	9.75	1.20	0.60	1.10
Drymaria cordat	7.21	3.605	8.81	3.34	1.67	4.51
Commelina benghalensis	6.90	3.450	8.64	2.97	1.48	3.12
Asystasia intrusa	6.03	3.015	6.64	2.18	1.09	3.02
Oxalis sp.	6.75	3.375	5.74	0.61	0.31	0.84
Total	200.00	100.00	216.64	200.00	100.00	311.33
Average			6.37			9.43

Some species of broadleaf weeds have higher botanical composition values in intensively managed coconut plantations compared to non-intensively managed plantation areas. Especially for *Eupatorium riparium*, *E. higrana*, *E. odoratum*, *Cynodon dactylon*, *Eleusine indica*, and *Eragrotis nigra*, the proportion of botanicals becomes very small in intensively managed plantations, that is from 22.13%, 13.42%, 13.33%, 12.82%, 12.62%, and 12.21% on unmanaged plantations, to 2.22%, 3.38%, 2.54%, 3.51%, 2.43%, and 2.34% in intensively managed plantations.

According to Crowder and Cheda (1982), the six poaceae weed species are highly favored by cattle, but they are not shade tolerant, so they are less potential as a source of rain in the shade of coconut trees. On the other hand, *Ottochloa nodosa* and *Axonopus compressus* are natural grasses that are preferred by livestock and are very shade tolerant, so they have great potential as a source of forage in the shade of coconut trees. Suboh (1997), explained that the types of weeds that usually grow between rows of oil palm trees are generally dominated by *Ottochloa nodosa*, *Axonopus compressus*, *Mikania scandens*, and *Asystasia intrusa*. These types of weeds usually grow well at an irradiation intensity of 40-60%. Cattle in general really like to graze this type of weed, some of them even contain nutrients whose quality can compete with cultivated feed plants.

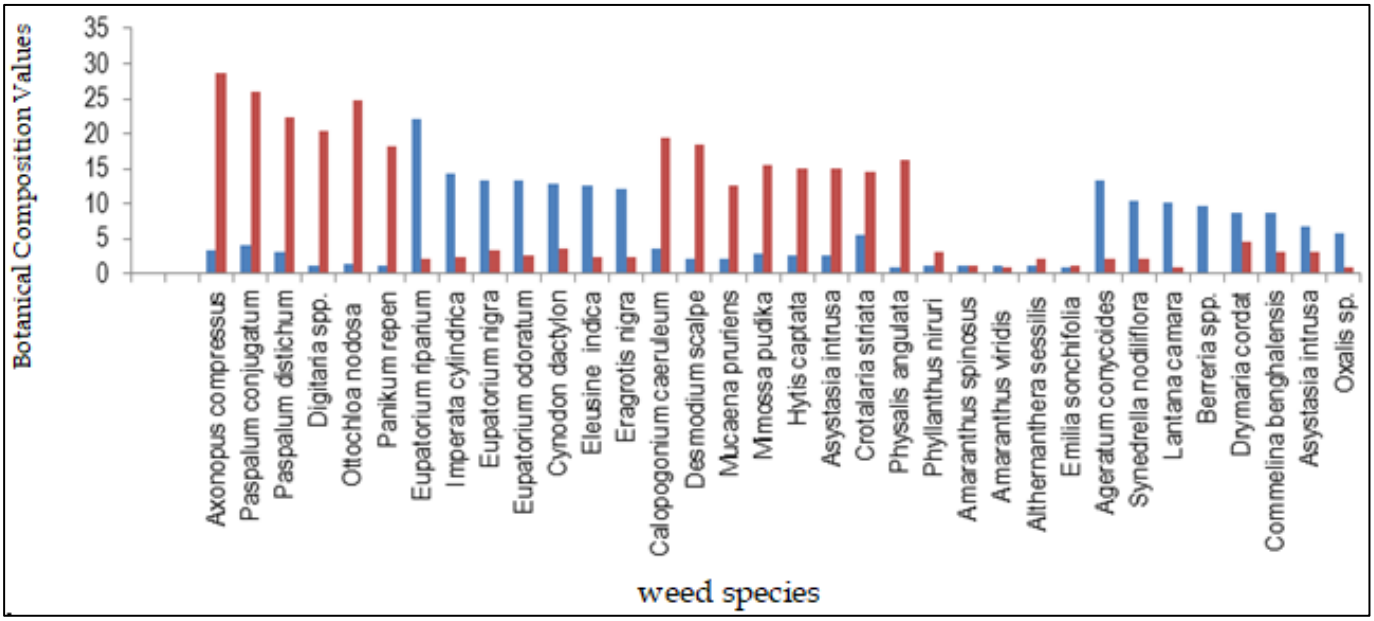

Figure 2. Botanical composition of dominant weeds in coconut plantations intensively managed (red) and non-intensively managed (blue)

The nutritional chemical composition of several types of weeds and other forages as feed was analyzed proximately to obtain protein, fat, carbohydrates, crude fiber and ash content. The data in Table 3 shows that there are four species of broadleaf weeds whose nutritional chemical composition is better representative than other types of broadleaf weeds. The types of weeds in question are *Hytis captata*, *Asystasia intrusa*, *Mimosa pudika* and *Crotalaria striata*. The content of protein, fat, carbohydrates and crude fiber of the four types of weeds is quite high with a lower ash content compared to other types of broadleaf weeds. In Table 3, it can be seen that all types of weeds in the Poaceae group have higher nutritional content than broadleaf weeds, soft weeds and sedges. Particularly *Axonopus compressus*, *Paspalum conjugatum*, *Paspalum distichum*, *Digitaria spp.*, *Ottochloa nodosa*, and *Panicum repens*, the values for protein, fat and carbohydrates in coconut plantations in non-managed and intensively managed areas were not significantly different from the average protein value of 8%, 5% fat, and 50% carbohydrates, with the lowest relative ash content of 4.36–3.32%.

It also appears that the protein, fat, carbohydrate and crude fiber content of each weed species tends to be higher in coconut plantations which are managed intensively compared to those which are not managed intensively, with lower ash content. The increase in protein content in weeds in intensively managed coconut plantation areas has something to do with the average age of coconut plants which have reached more than 15 years and their more fertile growth. In addition, in this area there are quite dominant standing plants among coconut trees such as sengon, gamal, turi, banana, lamtoro, kelor and others which sufficiently shade the weed vegetation that grows under these stands. The types of weeds that grow in this area are indeed quite tolerant of the intensity of sunlight which only shines on the coconut shaded soil from sunrise to noon. The increased content of protein, fat and carbohydrates in weeds and other forages that are shaded by coconuts that are more than 15 years old and more fertile is caused by 2 things.

First, due to changes in botanical composition. Weeds and plants growing under less fertile coconut plantations (plantation sites that are not managed intensively) are dominated by the species *Eupatorium riparium*, *E. higrana*, *E. odoratum*, *Cynodon dactylon*, *Eleusine indica*, and *Eragrotis nigra*, the original botanical proportions ranged from 13.33–22.13 %, being very small in intensively managed plantations with botanical composition values ranging from 2.22–3.34 % (Figure 2). On the contrary, the crude protein, fat and carbohydrate content of these weed species in plantations that are managed intensively are higher than plantations that are not managed intensively with less fertile growth.

Second, due to changes in chemical composition caused by shading both from coconut and other standing plants. Shade has a direct or indirect influence on the quality of forage, so it can change the chemical composition of the nutrients. Crude protein content is usually higher in the plant parts that are above than those that are below (Buxton and Fales, 1994). According to Kephart and Buxton (1993), crude protein concentration is much more responsive to shading than other quality components. It was also stated that 63% shade could increase the crude protein concentration by 26% in the weeds of the Poaceae family. This is related to the increasing concentration of nitrogen compounds

in plant cells. The increase in the concentration of nitrogen compounds due to shade usually plants experience a deficit of carbohydrates as a result of the large use of energy thereby sacrificing dissolved carbohydrates.

Table 3. The chemical composition of dominant weed nutrients in coconut shaded soil in plantation areas that are managed intensively and those that are not managed intensively

Weed Species	Unmanaged coconut plantation					Intensively managed coconut plantations				
	Protein (%)	Fat (%)	Carbs (%)	Ash (%)	Fiber (%)	Protein (%)	Fat (%)	Carbs (%)	Ash (%)	Fiber (%)
Axonopus compressus	10.22	5.62	55.63	10.72	18.64	10.42	6.12	56.62	6.32	26.17
Paspalum conjugatum	8.32	5.32	54.12	6.74	26.12	9.12	6.02	55.12	4.12	27.01
Paspalum distichum	12.42	6.72	62.26	4.81	14.04	13.21	7.63	63.41	4.01	12.66
Digitaria spp.	9.12	5.12	48.12	5.22	28.12	10.22	6.02	50.02	4.12	22.12
Ottochloa nodosa	10.20	5.43	55.12	4.36	24.12	12.32	7.12	56.72	3.32	21.46
Panikum repen	11.21	5.78	57.34	5.03	22.34	12.62	6.83	58.12	4.12	20.82
Eupatorium riparium	5.61	2.72	36.12	10.53	22.65	10.12	3.32	40.14	8.76	24.82
Imperata cylindrica	6.44	2.11	32.71	11.22	22.31	9.34	3.44	56.32	9.64	26.53
Eupatorium nigra	7.12	3.72	54.27	12.78	24.66	8.42	4.32	55.11	5.22	26.14
Eupatorium odoratum	2.34	0.43	30.62	13.31	16.84	4.61	1.43	46.14	9.82	23.62
Cynodon dactylon	1.32	0.12	29.32	13.44	20.82	4.12	1.04	42.24	10.04	21.62
Eleusine indica	1.32	0.11	31.81	13.24	24.17	2.43	1.62	38.81	12.22	22.34
Eragrotis nigra	1.43	0.12	28.42	14.86	26.41	1.82	1.54	40.13	12.66	26.23
C. caeruleum	2.36	0.44	19.62	34.64	22.16	2.72	0.83	20.75	45.22	32.56
Desmodium scalpe	1.34	0.14	18.22	39.21	20.31	1.72	0.62	34.26	44.51	18.21
Mucaena pruriens	1.32	2.12	36.74	17.62	23.14	2.32	3.22	37.14	19.61	25.11
Mimossa pudika	5.32	3.16	46.72	11.44	31.22	7.42	3.61	54.02	12.33	23.41
Hytis captata	7.32	4.32	50.12	6.71	36.12	9.10	6.72	55.10	9.12	27.18
Asystasia intrusa	6.24	3.24	45.64	12.31	30.32	8.46	4.72	52.32	14.28	22.67
Crotalaria striata	9.12	5.12	48.12	5.22	28.12	10.22	6.02	50.02	4.12	22.12
Ageratum conycoides	1.44	0.12	22.37	44.72	26.74	1.76	1.04	40.12	38.12	18.22
Lantana camara	1.04	0.04	28.41	36.76	28.22	1.32	0.42	32.62	41.62	26.82
Berreria spp.	4.32	2.12	38.12	18.62	25.21	5.74	2.32	39.64	32.31	22.67
Drymaria cordat	2.22	1.62	25.63	30.72	18.64	2.42	2.12	26.62	16.32	26.10
Commelina benghalensis	1.12	0.21	23.41	35.21	12.14	2.14	1.23	44.56	16.32	17.64
Asystasia intrusa	2.42	0.72	32.26	34.21	14.04	3.21	1.63	43.41	14.01	12.66
Oxalis sp.	1.03	0.41	23.63	36.21	14.14	2.00	1.21	41.52	16.30	18.62

Weed Species as Feed and Coconut shaded soil Capacity for Cattle

The data in Table 4 shows that the most widely used weed group as animal feed is the *Poaceae* family. More than 10 species of weeds from this family fall into the livestock preference level category from Liked to Very Very Liked with the percentage of inedible feed weight of 72.351–98.732 %. Whereas weeds from the Cyperaceae group were underutilized and in some samples were not utilized at all because apart from being less liked by livestock, it often causes bloating in cows' stomachs so that cows always burp. This weed group is included in the less preferred category with an inedible feed weight value of only 30.762%. Broadleaf weeds that dominate in the two study areas, also only a few species are used as feed, because more species are not preferred by livestock and have low chemical nutrient content (Table 3). Broadleaf weeds from the Fabaceae family are the most widely used as cattle feed. Then followed by several species from the family *Polypodiaceae* (ferns), *Apiaceae*, and *Acanthacea*. Several species from the families *Asteraceae*, *Melastomataceae*, and *Rubiaceae* were found to be quite dominant in the two study sites, but very few were used as feed. Most of these weeds fall into the Disliked to Very Disliked category with a percentage of feed weight only reaching 4.63–23.42 %.

The dominance of poaceae weeds greatly determines the quality of a forage source. Several broadleaf weeds, especially from the *Fabaceae* tribe, also determine the quality of forage sources (Nitis, 1979). Forage sources that are classified as good for producing feed are composed of grass (Poaceae) and legumes (Fabaceae) with a ratio of 6.5 : 3.5 (Umiyasih and Anggraeni, 2003). Six species of poaceae weeds found in intensively managed coconut plantation areas, apart from superior botanical composition and nutritional chemical content, also have a very high palatable value with an inedible feed weight of more than 95% and fall

into the preferred to very highly preferred category by cattle (Table 4).

Table 4. Weeds and other forage used as animal feed in shaded soil in two types of intensively managed and non-intensively managed coconut plantation agro-ecosystems

Weed Species	Familia	Life cycle	Inedible feed weight (%)	Category livestock preference level
Digitaria sanguinalis	Poaceae	Perennial	98.732	Very very liked
Digitaria ariantha	Poaceae	Perennial	96.721	Very very liked
Eleusine indica	Poaceae	Perennial	96.234	Very very liked
Paspalum conjugatum	Poaceae	Perennial	97.264	Very very liked
Paspalum distichum	Poaceae	Perennial	96.214	Very very liked
Cynodon dactylon	Poaceae	Perennial	98.332	Very very liked
Ottochloa nodosa	Poaceae	Perennial	97.562	Very very liked
Panicum repens	Poaceae	Perennial	89.818	Very liked
Axonopus compressus	Poaceae	Perennial	90.001	Very liked
Imperata cylindrica	Poaceae	Perennial	73.178	Liked
Ceperus rotundus	Cyperaceae	Perennial	30.762	Not enough liked
Ceperus irria	Cyperaceae	Perennial	31.221	Not enough liked
Eragrotis nigra	Fabaceae	Annual	30.456	Not enough liked
Calopogonium caeruleum	Fabaceae	Annual	75.634	Liked
Desmodium scalpe	Fabaceae	Annual	81.223	Liked a lot
Mucaena pruriens	Fabaceae	Annual	76.452	Liked
Mimossa pudika	Fabaceae	Perinnial	73.521	Liked
Hytis captata	Lamiaceae	Annual	4.632	Very disliked
Asystasia intrusa	Acanthacea	Annual	87.562	Very liked
Crotalaria striata	Asteraceae	Annual	23.452	Disliked
Ageratum conycoides	Asteraceae	Annual	24.762	Disliked
Mikania cordata	Asteraceae	Annual	58.214	Liked enough
Mikinia micrantha	Asteraceae	Annual	55.762	Liked enough
Clidemia hirta	Melastomata	Perennial	7.243	Very disliked
Borreria alata	Rubiaceae	Annual	5.256	Very disliked
Amaranthus spp.	Amaranthaceae	Annual	72.451	Liked
Cintella asiatica	Apiaceae	Annual	89.786	Very liked
Eupatorium sp.	Asteraceae	Annual	4.742	Very disliked
Artemisia vulgaris	Asteraceae	Annual	5.234	Very disliked
Galinsonga parviflora	Asteraceae	Annual	5.721	Very disliked
Drymaria cordata L.	Caryophyllaceae	Annual	60.452	Liked enough
Gamal leaf	Fabaceae	Perinnial	79.632	Liked
Lamtoro leaf	Fabaceae	Perinnial	60.748	Liked enough
Santen Leaf	Moraceae	Perinnial	34.672	Not enough liked
Jackfruit leaf	Moraceae	Perinnial	60.002	Liked enough
Sengon leaf	Fabaceae	Perinnial	54.782	Liked enough
Banana leaf	Musaceae	Perinnial	78.762	Liked
Corn straw	Poaceae	Annual	99.674	Very very liked
Peanut Straw	Fabaceae	Annual	92.764	Very very liked
Sweet potato	Convolvulaceae	Annual	90.572	Very liked

Manetje and Jones (1992), stated that almost all poacea weeds are palatable for ruminants. Awaludin and Masurni (2003), reported that *Asystasia gangetica* and *Paspalum conyugatum* weeds are palatable for cattle, but *Clidemia hirta* is not palatable, because these weeds smell pungent. These results are in accordance with Ali's study (2010), that weeds in cassava fields with strong odors such as *Ageratum conyzoides*, *Porophyllum ruderale*, *Stachytarpheta indica*, and *Turnera ulmifolia* are not palatable for cattle or goats.

Forage production per hectare, in coconut shaded soil in the two agro-ecosystem types was measured based on fresh forage production per m^2 per day, which was observed every 2 weeks. The contribution of weed biomass greatly determines forage production in each coconut plantation. Well-developed weeds and a balanced structure of species diversity between the narrow-leaved (poaceae) and broad-leaved groups can make a greater contribution to forage production. In addition to soil fertility and intensive land management, forage production is influenced by the degree of shade of coconut trees, the presence of standing plants as an alternative forage source and rainfall. The average forage production in coconut plantations that are not managed intensively is 3.33 $kw.ha^{-1}.day^{-1}$ and in coconut

plantation areas that are managed intensively as much as 4.87 kw.ha^{-1}.day^{-1}.

Based on the average production of forage in the two types of coconut plantation agro-ecosystems, the results of calculating the carrying capacity per hectare in coconut shaded soil for raising cattle in plantation areas that are not intensively managed are obtained at 0.83 ST ha^{-1} and in plantation areas that are intensively managed of 2.66 ST ha^{-1}. The capacity for raising cattle in coconut plantations that are managed intensively is higher than in coconut plantations that are not managed intensively, the reason is that it is closely related to the older the age of the coconuts, the higher the height.

The intensity of planting on coconut shaded soil and the high forage production that can be obtained per hectare every day. The same thing was shown by Wan Mohammad et al. (1997), that when coconut plants were 1-3 years old they could accommodate 3 cows ha^{-1}, then decreased to 2 ha^{-1}, when the plants were 3-5 years old. Then it decreased again to 1 ha^{-1} on plants aged 5-10 years and then increased again to 3 cows ha^{-1}, after the plants were 15 years old. It turns out that the shaded soil holding capacity of coconuts can be significantly increased through intensive soil and crop management and through rotational grazing at intervals of about 60 days. Chen and Dahlan (1995), suggest that the rotation system is carried out at intervals of 6-8 weeks in order to obtain a sustainable capacity. In addition to improving the grazing system, the number of types and quality of forage needs to be continuously improved. In terms of improving the quality of forage, you can also add soil-improving ingredients such as fertilization.

Conclusion

Dominant weeds that grow in intensively managed coconut plantation areas are more representative as a source of cattle feed compared to plantation areas that are not intensively managed, because 6 dominant species from the Poaceae group were found, namely *Ottochloa nodosa*, *Axonopus compressus*, *Paspalum conjugatum*, *Paspalum distichum*, *Digitaria spp*., and *Panicum repens*, as well as 6 broad-leaved species, *Calopogonium caeruleum*, *Desmodium scalpe*, *Mucaena pruriens*, *Mimossa pudika*, *Hytis captata*, *Asystasia intrusa*, and *Crotalaria striata*, which besides superior botanical composition and chemical nutritional content also have very high palatable value with a weight of more than 90% of the feed eaten and in the preferred to very very preferred category by cattle. The quantity and quality of weeds as a feed source based on average dry biomass weight, botanical composition and chemical nutritional content, weeds in coconut plantation areas that were intensively managed were higher than in coconut plantation areas that were not intensively managed. So that the average forage production obtained is higher, namely 4.87 kw ha^{-1} day^{-1}, while in plantation areas that are not managed intensively it is only 3.33 kw ha^{-1} day^{-1}. The holding capacity of smallholder coconut plantations for raising cattle in plantation areas that are not intensively managed is 0.83 ST ha^{-1} and in intensively managed coconut plantation areas is 2.66 ST ha^{-1}.

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