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Production and nutrient content of *Asystasia gangetica* (L.) subsp. micrantha grows in different locations

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Abstract
The location of plant growth can determine the growth and dry weight yield of forage achieved well. A growing place that is suitable for the type of plant planted is able to provide maximum and continuous forage. Research to determine the production and nutrient content of *Asystasia gangetica* (L.) subsp. Micrantha grown in different locations, using a completely randomized design (CRD) with 4 treatments and 9 replications. Treatment of *Asystasia gangetica* growing locations were: under banana trees (BP), on the road side (PJ), in the rice fields (PS) and on the coast (PT). The variables observed include: production variables, plant growth characteristic variables, forage nutrient content and soil nutrient content. The results of the research showed that the highest total dry weight production of *Asystasia gangetica* forage was obtained in the treatment rice fields (PS) growing locations of 21.19 g/m^2 with crude protein content (24.19%), crude fiber (15.87%), gross energy (4,260 kcal/kg) and this result is supported by the highest soil nutrient content in the rice fields (PS) treatment. It can be concluded that the growing location of *Asystasia gangetica* (L.) subsp. Micrantha in the rice fields (PS) can increase the total dry weight production of forage and the nutrient content of forage.

Keywords: *Asystasia gangetica* (L.) subsp. Micrantha, nutrient content, growing location, production

Introduction
Livestock productivity can be achieved optimally if it is supported by the provision of forage. Forage is the main source of feed for ruminant livestock which is used for basic living, growth, production and reproduction. According to Sirait *et al.* (2005) [9] almost 90% of ruminant feed requirements come from forage with daily fresh consumption of 10-15% of body weight, while the rest is concentrate and additional feed. Forage contains nutrients (Energy, protein, fat, fiber, vitamins and minerals) which are really needed to support livestock growth. Lack of feed can slow down livestock growth and can result in economic losses for farmers. Providing forage is an important thing to pay attention to, both through developing quality, quantity and continuity. Prasetyo and Suriadikarta (2006) [7] stated that generally the supply of forage experiences problems due to the influence of the season and the environment, such as the location of plant growth.

In general, the place where plants grow is soil. According to Sarwono (2010) [8], soil comes from the weathering of rocks mixed with the remains of organic material from organisms. These organisms can come from vegetation or animals that live above or below the ground. Soil functions as a medium for plant growth and a place for plant roots to absorb or absorb nutrients. Based on the fraction content of the soil, it can be grouped: 1) sandy soil with a sand fraction content of around 70%. This type of soil easily passes water, has good air conditioning and light soil cultivation. This sandy soil can be found on coastlines or near mountains that emit volcanic ash; 2) clay soil has a clay content of more than 70% and the nature of this soil is that it absorbs water slowly, has poor aeration, and requires heavy tillage. This type of soil is sticky when it comes into contact with water and breaks easily during the dry season and can be found in rice fields and surrounding areas; 3) clay soil contains sand, silt and clay fractions that are close to balanced. This type of soil can be found on moorland where the vegetation is quite dense.

The location where plants grow can affect the productivity of plants growing on that land, so that the forage produced will experience a decrease in production if the growing place is not suitable. Most subtropical plants grow in shaded areas and if nutrient and water requirements are not met, production will decrease. This is different from plants in areas that receive full sunlight.

Shade can affect the processes of photosynthesis and respiration which affect the growth rate and production of plants (Heddy, 1987) [3].

Forage as feed for livestock consists of fresh grass and legumes. This forage acts as the main feed for ruminant livestock, containing the nutrients needed by livestock for basic living and reproduction. Currently, farmers prefer forage that grows in the shade around gardens or agricultural land. The plants that grow are considered weeds and have the potential to be a source of forage. Farmers ignore the existence of weeds, because they are considered a nuisance plant. One of the weed plants that has the potential to be developed as a source of forage *Asystasia gangetica* (L.) subsp. Micrantha, contains high nutrients, high production and is able to grow in all types of soil.

Asystasia gangetica (L.) subsp. Micrantha belongs to the *Acanthaceae* family and is easily found around house yards, roadsides, gardens and open fields (Suarna *et al.*, 2019) [11]. Grubben (2004) [2] the advantages of the *Asystasia gangetica* plant are palatability and high digestibility. The nutrient content of *Asystasia gangetica* according to Witariadi (2023) [15] contains dry matter (90.79%), organic matter (84.31%), crude protein (21.56%), crude fiber (16.89%), crude fat (7.26%) and TDN (50.25%). Long-term use of *Asystasia gangetica* as ruminant and non-ruminant animal feed requires proper cultivation so that it is continuously available. In subtropical areas, the availability of forage varies greatly and depends on location or region, weather, temperature, water availability, soil quality and sunlight. *Asytasia gangetica* plants grow well under the shade of oil palm (Herilimiansyah, 2019) [4]. Shade can increase the regrowth of *Asystasia gangetica*, especially plant height, number of branches and inhibit flower growth (Kumalasari, 2019) [5].

This research needs to be carried out to find out how the production and nutrient content of *Asystasia gangetica* (L.) subsp. Micrantha that grows in different locations.

Materials and Methods

Plant Growing Locations

Collecting data in the field begins with determining the growing location of the *Asystasia gangetica* (L.) subsp. Micrantha, because the location where it grows can determine the productivity of the plant. Determining the growing location aims to: 1) obtain a growing location that is suitable or in accordance with the characteristics of the *Asystasia* plant; 2) produce forage with good quality and quantity, and is available throughout the year. To achieve this goal, soil samples from each growing location will be analyzed for soil nutrient content, as well as forage production from these plants will be analyzed proximately to determine the nutrient content of the forage.

Asystasia gangetica (L.) subsp. Micrantha and Soil

The *Asystasia* plants used are plants that grow naturally in predetermined growing locations. Starting with cutting parts of the plant simultaneously to get uniform growth. After cutting, plant samples were taken from each treatment to be analyzed for nutrient content. Soil samples were taken from each plant growing location to analyze the nutrient content.

Experimental design

The experiment used a completely randomized design (CRD) consisting of 4 treatments and each treatment was repeated 9 times. The treatment locations for *Asystasia* plants were: under banana trees (BP), on the road side (PJ), in the rice fields (PS) and on the coast (PT).

Mathematical model: $Yijk = \mu + \tau i + \sum ij$

Information:

i: 1, 2, 3, 4 (Treatment)

j: 1, 2, 3, 4, 5, 6, 7, 8, 9 (Repeat)

Yijk: Observation results of changes growing location in the-i with replication the-j

μ: Average of observations

τi: Influence of the location of the-i growing location

∑ij: Experimental error from the-i error on the-j observation

Observed Variables

The variables observed were: production variables (Fresh weight of forage, dry weight of leaves, dry weight of stems, and total dry weight of forage); variable plant growth characteristics (ratio of leaf dry weight to stem dry weight); soil nutrient content (pH, total N, available P, available K, and soil organic matter); and forage nutrient content (crude protein, crude fiber, organic matter, dry matter and gross energy).

Data analysis

The data obtained was analyzed using variance. If the treatments show significant differences ($P<0.05$), then the analysis continues with Duncan's multiple range test (Steel and Torrie, 1991) [10].

Results and Discussions

The results showed that the production of *Asystasia gangetica* (L.) subsp. Micrantha growing in rice fields (PS) gave the highest yield among other treatments. In (Table 1) it can be seen that the production of *Asystasia gangetica* in the PS treatment gave an average total fresh weight of forage (1,315 g/m2); leaf dry weight (9.93 g/m^2); stem dry weight (11.12 g/m2); total dry weight of forage (21.16 g/m^2); and the ratio of leaf dry weight to stem dry weight (0.88).

Table 1: Production of *Asystasia gangetica* (L.) Subsp. Micrantha Growing in Different Locations

Variable	Perlakuan[1)]				SEM[3)]
	BP	PJ	PS	PT	
Total fresh weight of forage (g/m^2)	1,285$^{a2)}$	1,204^{ab}	1,315^{a}	1,086^{b}	43.38
Dry weight of leaves (g/m^2)	7.71^{b}	8.17^{b}	9.93^{a}	5.78^{c}	0.21
Dry weight of stems (g/m^2)	8.95^{b}	10.78^{a}	11.23^{a}	8.93^{b}	0.19
Total dry weight of forage (g/m^2)	16.66^{c}	18.95^{b}	21.16^{a}	14.71^{d}	0.34
Ratio of leaf dry weight to stem dry weight	0.86^{a}	0.75^{b}	0.88^{a}	0.65^{c}	0.12

Information:

1) BP: under banana tree; PJ: on the road side; PS: in the rice field; PT: on the coast

2) Values with different letters on the same row are significantly different ($P<0.05$)

3) SEM: Standard Error of the Treatments Means

High production in *Asystasia gangetica* (L.) subsp. Micrantha grows in the rice field (PS) because this location contains more water and the availability of sufficient nutrients to grow, develop and produce plants well. Soil conditions with high water content cause the soil to become moist and can increase the C-organic content of the soil, so that the soil has high water vapor content. Moist soil can support the population of microorganisms in the soil to develop better and be able to decompose soil organic matter more quickly, so that the nutrients needed by plants are available earlier. Soil moisture plays an important role in microbial metabolic processes and indirectly affects oxygen supply (Purwawidodo, 1992) [6]. The results of the analysis (Table 2) of the soil nutrient content in the rice field (PS) location show that the soil C-organic content is high (3.38%), medium nitrogen (0.21%), high available P and K available (136.19 and 232.86 ppm).

The nutrients available in the soil at the rice field (PS) location cause *Asystasia gangetica* plants to be able to use these nutrients optimally for plant metabolic processes. The results of this metabolism can be used for plant growth processes and stored in the form of dry weight of forage. The results of this research show that *Asystasia gangetica* growing in the rice fields (PS) provides the highest total dry weight of forage among other growing locations. Wiguna (2011) [14] stated that a lack or excess of nutrients including N, P and K can have an adverse effect on plant growth. Furthermore, Sutedjo (2002) [12] stated that the nutrient N is the main nutrient for plant growth which is generally very necessary for the formation and growth of vegetative parts of plants such as increasing plant height, multiplying leaves, stems and roots. Furthermore, Syarief (1986) [13] stated that the nutrient N is the main nutrient for plant growth and is a constituent of all proteins and nucleic acids as well as a constituent of protoplasm as a whole. To see the quality of *Asystasia gangetica* (L.) subsp. Micrantha can be seen from its ratio value and this research shows that the quality of the forage at the location where it grows in the rice fields is the highest and this gives an idea that this plant has good quality. The high ratio value is due to the portion of the dry weight of the leaves being higher than the dry weight of the stem.

Table 2: Soil nutrient content at different growing locations

Variables	Treatment[1)]			
	BP	PJ	PS	PT
pH	6.84 (N)	7.12 (N)	6.8 (N)	7.12 (N)
DHL (mmhos/cm)	0.55 (SR)	0.72(SR)	0.56(SR)	0.67(SR)
C organik (%)	2.14 (S)	0.80(SR)	3.38(T)	1.69(R)
N Total (%)	0.16 (R)	0.02(SR)	0.21(S)	0.09(SR)
P available (ppm)	71.02 (ST)	34.84(T)	136.19(ST)	63.89(ST)
K available (ppm)	233.30(T)	91.75(R)	232.86(T)	207.88(S)
Kadar air (%)				
KU (%)	10.00	2.98	8.36	8.22
Texture				
Sand (%)	34.93	72.99	43.62	77.19
Dust (%)	34.61	17.59	21.21	10.17
Clay (%)	30.46	9.40	35.17	12.65
Structure	Clayey clay	Sandy loam	Clayey clay	Clayy sand

Soil Science Laboratory, Faculty of Agriculture, Udayana University (Witariadi, 2023) [15]

1) BP: under banana tree; PJ: on the road side; PS: in the rice field; PT: on the coast

Results of proximate analysis (Table 3) of *Asystasia gangetica* (L.) subsp. Micrantha in the rice field (PS) location contains organic matter (84.23%); 24.19% (PK); 15.87% (SK) and GE (4,260 kcal/kg). Nutrient content of *Asystasia gangetica* (L.) subsp. Micrantha, in particular, had the highest crude protein under banana tree (BP) at 27.27% and followed by in the rice field (PS) at 24.19%. Carbohydrate and protein content are components of the plant's dry weight, where the more carbohydrate and protein content in the plant, the higher the plant's dry weight (Budiana, 1993) [1].

Table 3: Nutrient Content of *Asystasia gangetica* (L.) Subsp. Micrantha Growing in Different Locations

Variables	Treatment[1)]			
	BP	PJ	PS	PT
Dry weight (%)	52.09	55.99	41.33	50.62
Dry matter (%)	93.95	91.72	92.83	93.17
Ash (%)	20.21	14.48	15.77	14.44
Organic matter (%)	79.79	85.52	84.23	85.56
Crude protein (%)	27.27	19.90	24.19	19.90
Crude fiber (%)	17.66	17.84	15.87	16.38
TDN (%)	45.87	43.19	47.99	46.09
BETN (%)	21.73	34.48	31.57	37.68
Gross Energi (kcal/kg)	3,774	3,142	4,260	4,154

Animal Nutrition and Forage Laboratory, Faculty of Animal Husbandry, Udayana University (Witariadi, 2023) [15]

1) BP: under banana tree; PJ: on the road side; PS: in the rice field; PT: on the coast

Conclusion

From the research results it can be concluded: 1) The location of plant growth influences the production and nutritional content of *Asystasia gangetica* (L.) subsp. Micrantha; and 2) The growing location in the rice field (PS) the best provides production and nutritional content of *Asystasia gangetica* (L.) subsp. Micrantha.

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Conflict of interest declaration

We certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

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