

FEED INTAKE AND DIGESTIBILITY OF *FICUS VARIEGATA* IN A CAPTIVE SUMATRAN RHINOCEROS AT ZOO MELAKA

by

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ABSTRACT

The Sumatran rhinoceros (*Dicerorhinus sumatrensis*) consumes a variety of plants in the wild. At the Melaka Zoo, these animals are fed with 3-6 varieties of *Ficus* and *Macaranga* species. An adult female used for this feeding trial consumed 26.7 kg of *Ficus variegata* per day. Selective feeding occurs after the first 1-2 kg. of forage, whereby the animal would only consume 36.9 cm from the shoots downward. The apparent digestibility of *F. variegata* in the study was 82.4%. Studies on the other forage consumed is necessary to ensure optimal feed intake and nutrient requirement of captive Sumatran rhinoceroses.

ABSTRAK

Badak Sumatra (*Dicerorhinus sumatrensis*) memakan berbagai jenis tumbuhan di dalam hutan. Di Zoo Melaka, binatang-binatang ini diberi makan 3-6 jenis pokok Fikus dan Macaranga. Seekor badak Sumatra yang digunakan di dalam kajian ini memakan 26.7 kg *Ficus variegata* setiap hari. Tabiat memakan secara memilih hanya dilihat selepas 1-2 kg. pertama, di mana badak tersebut akan hanya memakan 36.9 cm dari pucuk. Kadar penghazaman *F. variegata* di dalam kajian ini adalah 82.4%. Penyelidikan ke atas jenis-jenis tumbuhan lain yang dimakan adalah penting bagi memastikan amaun dan kandungan zat yang mencukupi untuk badak Sumatra di dalam kurungan.

INTRODUCTION

The Sumatran rhinoceros (*Dicerorhinus sumatrensis*) is a generalist herbivore (Flynn 1983, Mohd Tajuddin 1985). They occur in a variety of vegetation types but principally tropical rain forest (primary and secondary) including forest clearings and fringes, regeneration areas, swamp forest and dry deciduous forest (IUCN 1968).

Currently, there are information on the animal's feed habits and the variety of forage consumed in the wild. In Endau-Rompin, it was reported that although there is abundant forage availability, the Sumatran rhinoceros prefers selective feeding. The variety of plants consumed by this animal include: *Prunus spp*, *Ficus spp*, *Diospyros spp*, *Lasianthus spp* and *Macaranga spp*. Fruits of the wild and cultivated *Mangifera* were also consumed (Mohd Tajuddin 1982).

In captivity, these animals feed on a variety of forage, including carpet grass (*Axonopus compresses*), napier grass (*Pennisetum purpureum*), jackfruit leaves (*Artocarpus heterophyllus*), kelompong gatal (*Ficus glossolariodus*), kelompong hijau (*F. variegata*), tapak gajah (*Macaranga gigantia*) and daun tapai (*M. triloba*). In the wild there is sufficient browse to meet the animal's requirement for maintenance and production but in captivity, an indepth study on the forage consumed would

provide a basis for a successful management system.

At the Melaka Zoo, the Sumatran rhinoceros are fed with 3 to 6 varieties of greens (*Ficus* and *Macaranga* spp.), fruits, vegetables and concentrates. In order to formulate a ration for these animals, adequate information must be gathered through research on the nutrition of the Sumatran rhinoceros.

ANIMAL AND METHODS

An adult female Sumatran rhinoceros weighing 580 kg was used for this feeding trial. The animal was conditioned to consume only *F. variegata* throughout a period of 7 days. During this period she was fed at 3 specific times: 0830 hr, 1400 hr and 1800 hr. The feeding trial was conducted for a period of 9 days. The total amount of forage offered was 45 kg daily. The forage was placed on the floor of the pen. The faeces was collected in the morning and recorded. The amount of forage rejected was separated into stems and leaves before weighing.

Prior to offering of forage to the animal, 40 – 50 stems were measured and their length recorded. After feeding, these were collected and remeasured. Samples of leaves and stems rejected were sent to the laboratory for nutrient analysis. Fecal samples were also collected for analysis. From the result, the voluntary feed intake, length of *F. variegata* consumed and digestibility percentage were calculated.

RESULTS

Voluntary feed intake (V.F.I.) of *F. variegata* (moist content of 79.7%) averaged 27.6 kg per day or 0.95% of the animal's body weight in dry matter (Table 1).

Table 1: Voluntary feed intake, fecal output and apparent digestibility of *F. variegata* in a Sumatran rhinoceros.

Parameter	Average	Range
Feed intake (kg/day)	27.6	23.7 - 29.8
Fecal output (kg/day)	4.9	2.8 - 8.6
Apparent Digestibility (%)	82.4	-

The rejected forage averaged 17.4 kg with a stem to leave ratio of 1:1.66 while those of the offered forage averaged 1:2.03. The forage offered ranged in length from 44-110 cm. The preferred portion of the *F. variegata* was 36.9 cm from the shoot downwards (Table 2). This varies with the time of feeding. During the morning, the rhino would consume the entire stem of the first 1 or 2 kg of the forage offered. This is followed by a more selective feeding.

The Sumatran rhinoceros under study defecated 2-3 times daily. In the morning, the rhino defecated between 0715 hr to 0800 hr and around 1700 hr in the evening. The daily fecal output averaged 4.85 kg with a range of 2.8 – 8.6 kg.

The ambient, rectal and skin temperature ranges between 23 – 31°C, 36.9 – 37.9°C and 36.2 – 37.1°C respectively.

Table 2: Selective feeding of the Sumatran rhinoceros in captivity to *F. variegata*.

Parameters	Average	Range
Length offered (cm)	71.6	44 - 110
Length left over (cm)	34.7	10 - 93
Leaves left over (kg)	10.8	8.8 - 12.8
Stems left over (kg)	6.5	5.8 - 9.9

DISCUSSIONS

The voluntary feed intake of 0.95% of body weight was lower than a previous report of 1.3% (Van Strein 1985). This difference could be due to the feed and feeding systems. In the large generalist herbivores there are a variation in the nutrient level of the forage consumed (Westoby 1974). The voluntary feed intake varies with the feed, feeding systems and the physiological state of the animal. There is a gradual decrease in voluntary feed intake as the ambient temperature approaches 32°C and an abrupt drop occurs as the body temperature approaches 4°C (Baumgardt 1969). During this study, the ambient temperature ranged from 23 – 31°C. The rectal and skin temperature of the captive Sumatran rhinoceros in the night stall averaged 37.4°C and 36.7°C respectively.

In the wild, the rate of browse production is reported as 1 gm/m²/day (Van Strein 1985). Using this yield, the minimum range required to support the daily requirement of an adult female Sumatran rhinoceros on *F. variegata* would be 2.76 ha.

The apparent digestibility of *F. variegata* was 82.4%. Several factors that affect the digestibility include the crude protein (amount and composition), food preparation and the level of feeding (McDonald et al. 1979). Fecal output averaged 4.85 kg with a moisture content of 32.5%.

In the captive situation, there are limitations as to the variety of forage offered. Under this circumstances, the rhinoceros adapts quite well, although there is a great tendency to be selective when given the opportunity. Sumatran rhinoceros feed on the young leaves and stems. Occasionally, bark of the young saplings of a wide variety of mid-canopy forest trees. The saplings are found in the understory of the forest and range from 2.0 to 10.5m in height and 0.8 to 8.0 cm in diameter at breast height (Flynn 1978). There are 102 plant species reportedly consumed, of which the preferences

ranges from leaves, twigs, fruits, barks, wood and flowers (Van Strein 1974). In captivity, the Sumatran rhinoceros consumes the first 1-2 kg of *F. variegata* offered (44-10 cm long) without being selective. Subsequently, the animal would select and consume the most palatable portion. This length averaged 36.9 cm from the shoot downwards. This value would be useful to determine the harvest or cutting levels of the forage. Under a normal situation, the *F. variegata* would be cut at a very low level, exceeding the 110 cm mark. This can result in an inadequate leaf area which will lower the production rate.

The type of feeding stuffs and the methods of feeding are critical in the captive management of the Sumatran rhinoceros. Improper feeding would result in a sudden change in the microflora of the hindgut. The sudden change of forage in the diet of the Sumatran rhinoceros at the Port Lympne zoo resulted in the death of a female Sumatran rhinoceros (Furley 1987).

At Dusit Zoo, Thailand, the feeding method employed resulted in the death of another female Sumatran rhinoceros in captivity (The Star 1986). The animal caught its head between the iron bars within the enclosure during feeding. Apparently, the gap was too wide thus permitting the animal's head to go through. At Zoo Melaka, a 16 cm gap was recommended to prevent such incident. In Torgamba, Indonesia, the male Sumatran rhinoceros "Rokan" was fed only a small variety of forage. Occasionally, he was fed on nangka leaves (*Artocarpus heterophyllus*) alone. A variety of browse should always be provided as the Sumatran rhinoceros is selective in its feeding habits. The head feeding method from the upper part of the stockade resulted in the animal having to stretch its neck abnormally to consume the more palatable portion of the forage (Mohd Tajuddin and Zainal Zahari 1987). At the Zoo Melaka, the death of a male Sumatran rhinoceros was due to a severe colic, possibly associated with feed (Zainal Zahari et al. 1989).

Supplementation with concentrates or other high energy feed might not be optimal unless such information as feed intake, feed selection, digestibility and nutrient requirements are considered. Similarly, feed intake is also influenced by stress, sex and body weight. The supply of forage from the forest is limited and constantly on the decline due to land development. In the near future, it might be necessary to cultivate and manage the forage species mentioned to meet the increase demand.

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