Domestic Goat (*Capra hircus*) Food Preferences for Alien Hawaiian Plants

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Abstract:

The purpose of this study was to test the food preference for alien Hawaiian plants in domestic goats. Eight domestic goats were given 450 grams each of four plants which were processed to similar sized pieces. After 15 minutes the amount consumed of each of the four choices was weighed. The daily results for each plant were averaged for the 14 days of the study. An ANOVA with Tukey’s post hoc concluded that domestic goats preferred Ti-leaf. This preference could be due to taste (sugar content) or some other chemical, physical, or nutritional property of this species.

Introduction:

The Domestic Goat (Capra hircus) selectively forages on plants based on their nutritive quality (Baraza et al. 2009). Provenza (1995) proposed the Hedyphagia Model which suggests that ruminants possess a degree of “nutritional wisdom”, generally selecting foods that meet their nutritional needs. Ruminants select plants using olfactory, gustatory, and tactile senses. Goats analyze the odor and taste based on postingestive feedback to determine the nutritional value before ingesting (De Rosa et al. 2002). Fisher et al. (2002) found ruminants preferred alfalfa hay harvested late in the day. They proposed that the higher sugar content in the hay was positively correlated to the time of day it was harvested.

Goats are known to prefer particular free range grasses that may enhance the quality of their diet (Ganskopp et al. 1996). They also reported that the free range diet of goats included various types of grasses and shrubs. They also found that goats will not thrive if kept on a single food source for an extended amount of time. Domesticated goats from the Mediterranean have a less diverse diet than feral or wild goats which select for different foods depending on seasonal changes in vegetation (Aldezabal and Garin 2000). In order to manage a suitable pasture, it is important to know how livestock select their food and the factors that influence these choices (Barroso et al. 1993). Lignifications of the plant cell wall create a limiting factor for the ruminant’s digestibility and amount of intake for each plant (Silanikove 1986). Digestibility is...
also affected by the different physical and chemical characteristics of the forage (Provenza 1995). Dry matter for most ruminants tends to be easier for them to digest (Slanikove 1986).

Food preferences in a free range diet of domestic goats in Hawaii have not been reported in the literature. The purpose of this study was to test if domestic goats in Hawaii have quantifiable preferences between four different non-native plants.

**Methods and Materials:**

Eight female one-year-old goats were chosen. These goats were hand raised, non-lactating, and had never been bred. They were kept on a goat farm in Kapa’a, Kaua’i, Hawai’i. The goats were given a choice of four common non-native plants to test for preferences: *Leucaena leucocephala* (Koa Haole), *Cordyline fruticosa* (Ti Leaf), *Heteromeles arbutifolia* (Christmas Berry), and *Spathodea campanulata* (African Tulip). The test plants were harvested the evening before each test. The leaves were stripped from the stems and were cut into approximately 5.1x 2.5 centimeter pieces. The leaves were then put in a cooler with ice so that they could be presented green (fresh). The test stall was 2.1 x 1.5 meters with two doors and a window. Four feeding boxes of equal size and build were placed on the ground. These containers measured 43 x 46 x 31 centimeters and were constructed of plywood. 450 grams of each plant leaf material was presented to each goat, after 15 minutes of observation the goat was removed and the uneaten leaves were weighed. Each goat was tested separately. The foods in the boxes were rotated every testing session but the containers remained in the same place in the stall. This made sure that the goats were not just going to a particular box. The preference in plants was measured by the amount of each plant consumed in the 15 minute time period. The goats were divided into two groups of four, which were tested on alternate days over the two week study. Goats were tested in the morning before they began grazing. After testing the goats

Comment [RSG1]: Was this an average? If so, you may need to report standard deviation "453.6 ± 5 g of each plant material..." or simply state "approximately 450 g of each plant material..."
were allowed to resume their normal eating patterns throughout the day.

**Results:**

Analysis of four plants consumed by the goats in this study was measured by the amount (weight) eaten in a 15 minute period. ANOVA showed a statistical significance ($P<0.05$) for Ti-leaf. Differences were determined by Tukey’s Multiple post hoc. The means (per day per plant) over a 14 day period found the plant most consumed was Ti-leaf, followed by African Tulip, Koa Haole, and Christmas Berry (Fig. 1). The amount (grams) consumed per day by all eight goats were: Ti-leaf $250 \pm 129$; Koa Haole $78 \pm 96$; Christmas Berry $76 \pm 67$; and African Tulip $102 \pm 84$.

![Figure 1](image)

Figure 1. The average amount (per plant per day) of each test plant consumed per day over the 14 day test.

**Discussion and Conclusion:**

This study tested if domestic goats had a preference for different alien plants in Hawai‘i. The most preferred and consumed test plant was Ti-leaf. The least preferred and was Christmas
Berry. These preferences could be a result of the chemical, physical, or nutritive properties of the plant. Christmas Berry has a strong odor, which may be a defense against herbivores or insects. This could account for the lack of preference for this plant. Koa Haole’s compound leaves may have made it more time consuming to eat therefore, less attractive. Ti-leaf and African Tulip have large leaves and no strong odor which could account for their preference. The high preference for Ti-leaf might be due to a high sugar content giving it a sweeter and more appealing flavor to ruminants. They might prefer Ti-leaf for its nutritional value.

The goats in this study were all in good health and the weather remained consistently sunny with little cloud cover for the whole 14 day test which negated changing weather or health issue variables. For farmers thinking about raising goats in Hawai‘i Ti-leaf might be a beneficial plant supplement. Ti-leaf plants cannot survive foraging goats but would need to be grown separately and the tops containing the leaf be harvested periodically.

Comment [RSG2]: Do you have any information on the nutritional values of these four plants? Rather than state that they "might prefer...for its nutritional value," it would be nice to list the comparison.


