



Behaviour and dietary preferences of browse species by sheep on natural pasture in Ninh Thuan province in the south-central region of Vietnam



by

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Abstract

This MFS was conducted in Ninh Thuan province, in the south-central of Vietnam, a developing country in the south-east of Asia. The Ninh Thuan province consists of large areas of natural rangelands, which are used for animal grazing. The area is unique in Vietnam because of the hot and dry climate, which means that the vegetation is limited and the botanical composition very special. Due to the low amount of rainfall over the last years there has been a decrease in productivity and changes in the botanical composition. Ninh Thuan has the highest production of sheep in Vietnam and in 2005 there was a total number of 56,800 sheep. The sheep are of the breed Phan Rang, which can only be found in this area, and is very well adapted to the harsh and dry climate. Sheep are grazers, but when feed is scarce they are dependent on browsing.

One herd of between 20-200 sheep was followed on pasture during 17 days between 4th of April and 13th of May, in order to study their behaviour and browse preferences. Observations were taken every 15 minutes to a total number of 438 registrations. The sheep were on pasture approximately between 7 am and 5 pm with a break between 11 am and 1:30 pm. Activities that were recorded are walking, grazing, browsing, eating dead plants, and other activities such as sniffing, scratching, suckling and urinating. Twelve interviews with local farmers were also conducted in order to achieve an insight of the farmers' view of the agricultural situation.

The results showed that the most common activities are grazing (61.2%), walking (22.5%), eating dead plants (7.0%) and browsing (6.6%). There was no significant difference between the proportions of different activities in the morning and afternoon, but still a higher proportion of browsing could be seen in the morning. The most preferable browse species among the sheep were Xuong Rông (*Opuntia monacantha* Haw, cactus), 21.9%, Long giấy (not classified), 18.8%, Bôn bôn (*Calotropis gigantean*), 15.6%, Chùm lê' (*Azima sarmentosa*), 9.4% and Dải chôn (not classified), 6.3%.

This study will hopefully contribute to the species selection for reseeded the browse species.

Introduction

Vietnam is a developing country in the South East Asia with a population of 84.4 millions out of which 54.3 millions are involved in agriculture production. Areas used for crops as well as pasture land are increasing in Vietnam due to the increase in human population and in the number of livestock. Of the total land area of 325,490 km², 29.3 % is used for agricultural purposes and 6.7 % of the total land area is pasture. Agriculture accounts for 22.6 % of the GDP, out of which 18.6 % is livestock (FAO (1), 2007).

The capital of the Ninh Thuan province, in south-central Vietnam, is Phan Rang-Thap Cham. The province has a total area of 336,000 ha out of which 72,000 ha (21.5 %) is used for agricultural purposes. Most of this agricultural land is pasture, 50,500 ha, which is also called unused land and 3,700 ha is cultivated grass. This is a very unusual situation in Vietnam where generally most of the arable land is used for agriculture production and the proportion of land for pasture is small. In 2005 there was a human population of 564,400 inhabitants in the province, and of them 382,000 were living in the countryside (Statistical yearbook 2005, Ninh Thuan). About 100,000 families are farmers (Vu, 2007). The province consists of five districts. Ninh Phuoc district is situated in the west and has an area of 90,600 ha, out of which 25,000 ha is agriculture land, 20,500 ha is pasture and 33,300 ha is forest land (Statistical yearbook 2005, Ninh Thuan).

Ninh Thuan province (Fig. 1) is a unique area since the sandy soils and the hot and dry climate differ largely from the rest of the country. In 2005 the average temperature was 27.4 degrees with a maximum temperature of 30 degrees in June and minimum of 24.2 degrees in January. The annual rainfall was 834 mm, with the highest amount in December and no rain at all in January, February and April (Statistical yearbook 2005, Ninh Thuan). The province consists of large areas of natural rangelands, which are used for animal grazing. The land is both government-owned and privately owned by farmers. Most of the farmers receive a red book stating their ownership to the land (Vu, 2007). The animal production is dependent on this natural grazing land, which has been used for animal grazing for a long time. During the last years, the rainfall has been low, which has resulted in decreased productivity and changes in the botanical composition of the natural grassland. The botanical species are adapted to this climate and therefore the composition of species is special in this area (Van, 2006). At present there are no rules or restrictions from the government concerning the use of the land, but there are plans made for how to control the utilisation of the land in the future and how to re-grow the plants (Vu, 2007).



Fig 1. Ninh Thuan province

Because of the arid climate, desertification and land degradation are major problems in the Ninh Thuan province. Overgrazing is the cause of vegetation depletion, increased soil erosion, deterioration of soil fertility and soil structure. Since livestock is allowed to graze freely, the degradation of the land accelerates (United Nations Developing Programme, 2007).

Several plants from the rice and maize fields serve as forage. The majority of them are weeds, but by-products such as straws, stovers and elephant grass are used to a large extent. The scarcity of good quality pasture, especially in the dry season, is a major problem. The farmers need to extend the cultivation of forage and use the available fodder trees to supplement the poor quality roughage (FAO (2), 2007). In Ninh Thuan province, the extension centres teach the farmers within the agriculture sector in order to improve their knowledge in sustainable landuse. There are about 50 different browse species in Ninh Thuan province and the animals are allowed to browse on different areas depending on the seasonal growth of the plants (Vu, 2007).

In total, there was 56,800 sheep in Vietnam in 2005 (FAO (2), 2007). The Ninh Thuan province has the highest production of sheep in Vietnam, with a number of 42,000 (73.8 %) in 2005, including both pure Phan Rang sheep and cross-breeds (Statistical yearbook 2005, Ninh Thuan). The breed is mainly a local breed called Phan Rang sheep. The Phan Rang sheep is a breed only found in the Ninh Thuan province, and they are well adapted to the harsh and sometimes very dry conditions. They were introduced by missionaries from India, Pakistan and Africa. In 2003 the population of Phan Rang sheep was about 25,000 heads. The usual herd size varies from about ten to hundred animals. The Phan Rang sheep are used mainly for meat production and the breeds Dorper and White Suffolk are used for crossing to increase the weight gain. The mature weight is 39 to 45 kg and 34 to 38 kg for males and females, respectively. The sheep preferably eats grasses and shrubs, but by-products such as banana peel, molasses and bagasse can also be consumed as a complement. A mature ram consumes approximately 5 to 7 kilos/day in fresh weight (Mai *et al.*, 2006).

The livestock production represents 30 % of the agricultural economy in Ninh Thuan. In 2005 the meat production from sheep was 426 ton (Statistical yearbook 2005, Ninh Thuan). The number of animals and the production of meat have increased during the last years, along with the human population. At present in 2007, the price of meat is very low and there are problems for the farmers to sell the animals. That means that the farmers have not enough feed for the animals, and many sheep die or get sick from starvation. About 15 % of the sheep dies because of diseases (Vu, 2007).

Sheep can be produced successfully even in rangelands with vegetation of low nutritional value, but they have to move long distances to cover their dietary needs. They prefer grazing, but when feed is scarce they rely on browsing. Sheep spend about ten hours for feed intake during twenty-four hours divided in four to seven periods. Between the periods they ruminate, in total for about eight hours (Jensen, 1993). Sheep are more selective than larger ruminants because of their narrow bite and a split upper lip (Sanon *et al.*, 2005). To be a successful browser, the animals have to reach as high as possible. Sheep browse at a mean height of 0.7 m in the dry season (Ouédraogo-Koné *et al.*, 2006).

Material and methods

The study was conducted from 6th of April until 13th of May in Phước Hữu commune, Ninh Phước district, Ninh Thuan province, situated in south-central Vietnam. The climate is a combination of tropical monsoon and dry and windy weather. The dry season is from December to July and the rainy season is from August to November (Van, 2006). The farm is owned by the farmers Truong Trung and Nguyễn Thi Du, and they have two families employed for managing the animals. About 620 sheep and 57 cows are kept. The sheep are kept in houses standing on poles, Fig. 2. The sheep are mainly of the breed Phan Rang. They also have four imported Dorper males from Australia which have resulted in about 250 cross-bred animals. The farm consists of 70 ha of pasture and 1 ha of elephant grass. There is one well for the animals. The sheep are given supplementary feed in the form of elephant grass (*Pennisetum purpureum*), Fig. 3. The farmer vaccinates the sheep against enterotoxaemia and pasteurellosis and therefore there are not many diseases among the animals but in 2007 200 sheep died from starvation up to the middle of May.



Fig 2. One of the houses where the sheep are kept.



Fig 3. Supplementary feed in the form of elephant grass.

For the study of the behaviour and the preference of browse species by sheep, a herd of 20 to 200 sheep was followed on pasture during three to five days a week for five weeks, Fig. 4. The observations took place when the animals were out in the rangeland, approximately between 7 am to 5 pm, including a break between 11 am and 1:30 am.

When not on pasture, the animals were kept at the farm. At the break, the animals could drink water and eat elephant grass (*Pennisetum purpureum*). Sometimes they also had access to water at the pasture. The sheep were monitored by a herder, but they could move in large areas. One lactating female from the herd was randomly selected each observation day and activities were recorded every 15 minutes. The total number of observations per day was dependent on the time the animals spent on pasture, varying between 20 and 31. In case of rain, the sheep went back to the farm. Four of the afternoons in the study were excluded because of high rainfall. Examples of activities that was recorded were: grazing, browsing, walking without feeding, eating dead plants, ruminating, drinking, and other activities including scratching, sniffing, suckling and urinating. The plant species was identified with a local name by the farmer or herder.



Fig. 4. Sheep on pasture.

Interviews with twelve local farmers using the area in Ninh Phước district for their animals were carried out. The purpose of the interviews was to achieve an insight into the farmers' view of the agricultural situation. Examples of questions in the interviews were:

- How many animals do you keep and what are the species and breeds of the animals?
- How large is the pasture area you are using, are the animals kept in a restricted area?
- What kind of browse species does the pasture area that you are using contain?
- Have you noticed any browsing patterns (seasonal, diurnal) among your animals?
- Where do the animals drink water and how many times a day do the animals drink?
- How many hours a day do your animals stay on pasture?
- Do you provide the animals with supplementary feed?
- Do you experience problems with desertification and land degradation?
- Are there any problems with diseases among the animals?
- Are there any rules regarding how to use the grazing area?
- Is there any organization or authority controlling the number of animals and utilization of the land?
- Which measures do you believe are necessary to carry through in order to improve the pasture area of Ninh Phước district?

Data were analysed statistically using Minitab programme, version 14. The main factors were behaviour activities as walking, grazing, browsing, eating dead plants and other activities. By using Tukey's pairwise comparison procedures significant differences could be analysed between the browsing activity in the morning and afternoon. The most common behaviour activity and the most preferred browse species are illustrated in diagrams using Microsoft Office Excel 2003.

Results

Table 1 shows mean values, standard deviation and minimum and maximum value of the number of recordings and the most common activities during each day. Other activities than walking, grazing, browsing and eating dead plants were only recorded once or twice, and is therefore put together as one activity.

Table 1. Number of recordings, and mean value, standard deviation and maximum and minimum value for the most common activities each day.

	Mean	SD	Minimum	Maximum
Number of recordings	26.6	3.4	20.0	31.0
Walking (%)	22.5	8.5	7.1	40.0
Grazing (%)	61.2	14.9	41.9	85.2
Browsing (%)	6.6	5.7	0	16.1
Eating dead plants (%)	7.0	4.9	0	18.5
Other activities (%)	2.5	3.1	0	7.1

The sheep spent most of the time grazing (61.2 %). The second most common activity was walking (22.5%), and that includes searching for feed and going to or returning to pasture. Eating dead plants (7.0%) includes moments when the animal was eating at the ground but where no living plants were present. Browsing showed surprisingly low activity (6.6%), but this was very dependent on where the herder took the animals. When comparing the morning and afternoon, there was no significant difference between the activities. The average number of browsing observations in the morning was 8.5 % compared to 4.3 % in the afternoon, but the difference was not significant. There was also a higher activity of browsing after rain, since the sheep do not like wet grass (Tuê, 2007)

Approximately 53 browse species were found on the pasture, and thirteen of them were once or more often consumed by the sheep, Fig. 5. Two of the consumed browse species; Thanh long (*Hylocereus undatus*, dragonfruit) and Thuộc là (*Nicotiana tabacum*, tobacco plant) were not grown at the pasture but in a area nearby where the animals went.

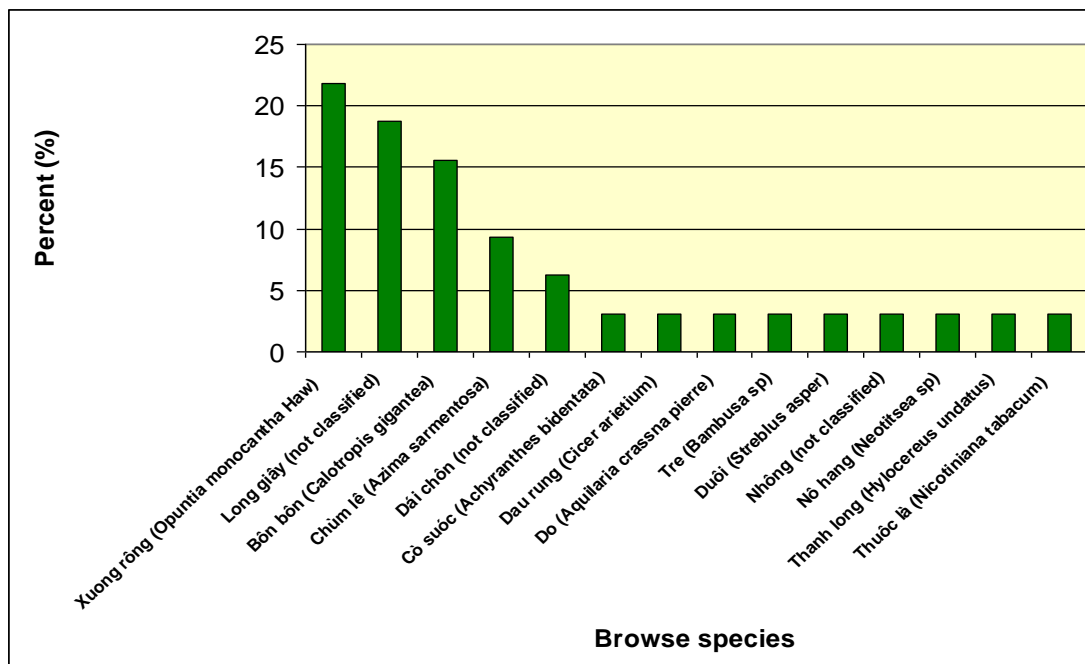


Fig 5. The most preferred browse species among the animals.

The three most preferred browse species among the animals were Xuong rông (*Opuntia monacantha haw*, cactus), Fig. 6, and then Long giây (not classified), Fig. 7, and Bôn bôn (*Calotropis gigante*), Fig. 8.



Fig 6. Xuong rông



Fig 7. Long giây



Fig 8. Bôn bôn

Twelve interviews were conducted in Ninh Phước district. Three different communes were chosen (Phước Hữu, Phước Thái and Phước Nam) and in each commune two villages. The farmers had between 10 and 600 sheep, with an average of 179. The breed were mainly of the local variety Phan Rang, but five of the farmers had also imported Dorper males. The farmers owned in average 14 ha of land, which is used for pasture and growing elephant grass (*Pennisetum purpureum*), rice (*Oryza sativa*), Neem trees (*Azadirachta Indica Ajuss*), Cashew trees (*Anacardium occidentale*), mango (*Mangifera*), tobacco plants (*Nicotiana*), soybean (*Glycine max*) and corn (*Zea mays*). The farmers could mention in average 3.2 browse species, since they usually have herders employed they are not themselves at the pasture with the animals. In the dry season, they keep the animals on pasture between 7 am and 5 pm, with a break between 10:30 am and 1:30 pm when the animals can drink water and eat supplementary food. Most of the farmers have a well or a pond at his farm. In the rainy season the animals are normally kept on pasture all day, since they do not need to go back to the farm for drinking water. The sheep were offered supplementary feed in the form of elephant grass (*Pennisetum purpureum*) mainly and in case of disease or weak animals they were given concentrate feed from the factory. The four main diseases are liverfluke, enterotoxemia, pasteurellosis and sheep and goat pox, but the farmer vaccinates the animal if they can afford it. The main mortality reason is starvation.

The farmers experienced no problems regarding desertification or soil erosion in two of the villages, Phước Hữu and Phước Thái. In Phước Nam there is serious problems regarding water supply and the soil erosion and desertification accelerates. Two of the farmers think that the soil is low in nutrients and that they have problems near the mountains with soil erosion. They use the faeces from the animals to fertilize the soil and cultivate Cashew trees (*Anacardium occidentale*) and Neem trees (*Azadirachta indica ajuss*) to keep the soil moist and cool. At present there are no controlling measures of the number of animals and the utilization of the land. If the farmer owns the land he will receive a red book with an ownership certificate, otherwise they can use the government land.

The agriculture extension centre in Phan Rang gives advice to the farmers within the agriculture sector. Most of the farmers agree that it would be a good idea to have a plan for the utilization of the land, some areas are more profitable for raising animals. Some of the farmers also wanted to improve the variety among the animals and import breeds from other countries, like Dorper from Australia. They also wanted to improve the variety of browse species that can stand the harsh conditions in the dry season. Since the employed herders on

the farm receive the faeces from the animals, the farmers need to buy fertilizer. This is not a good way, the faeces should stay at the farm. They also think that the government should support them with more money and that it should be easier for them to get a loan from the bank. Since the price of meat is very varying in different years they would like to have a stable price setting.

Discussion

This survey shows that the sheep spent less time browsing than expected (6.6 %). According to Ouedraogo-Kone *et al.* (2006) study sheep in Burkina Faso spent 23.5 % of their time browsing in the dry season. An explanation to why this study showed different results can be that the pasture in the present study was very dry and most of the trees and bushes were already browsed up to the height that the sheep are able to reach, Fig 9. The same case appeared in the study of Ouedraogo-Kone (2006) where the herders had to cut down branches for the animals. This study also showed a higher proportion of "eating dead plants" than browsing, that can probably also be explained by the low amount of reachable browse species. Grass species were still present at the pasture and the sheep are in first hand grazers. Many bushes could be seen at the pasture that had been rejected by the animals. The browsing activity was very dependent on the herder and where he monitored the animals, in some areas it was less grasses present and more browse species. It was also possible to observe a higher activity of browsing after rain, since the sheep do not like wet grasses. Most of the time it was very dry in the area, and they preferred the dry grasses. According to Ouedraogo-Kone *et al.* (2006) and Sanon *et al.* (2007) sheep spend between 14.5 to 15.4 % of the time walking. The higher proportion of walking in this area can be explained by the scarcity of browse species. The animals need to walk longer distances to search for the feed.



Fig 9. Bushes was browsed up in the lower part

There was no significant difference between the browsing activity in the morning and afternoon, but there was a higher proportion of browsing in the morning. An explanation to this can be that it was cooler in the morning, and the animals could move over larger areas and find more trees and bushes. It seemed like the animals were more satisfied with grass and dead plants in the afternoon when it was warmer.

The number of browse species selected by the sheep was 14. The approximately total number of browse species in the area is about 55. Many of the species were too high for the sheep to reach or were not present frequently where the animals were grazing and browsing. Xuong rông (*Opuntia monacantha* haw, cactus), Long giây (not classified), and Bôn bôn (*Calotropis gigante*), was the most preferable species and they were present in a large numbers on the pasture.

There are factors that might have influenced the results. The presence of the observer, herder or other people can have disturbed the animals and they may have behaved differently if grazing alone. In this study, there were three different observers and that can affect the observations. As mentioned before the herder monitored the animals to different areas, and that affected the browsing activity.

Since the animals were moving in a large area and the heat is very intense in the dry season it was not possible to register the behaviour of the animals more often than every 15 minutes.

Conclusions

The sheep browsed to a surprisingly small extent, probably because of the scarcity of browse species. This could also be the explanation of the higher activity of walking. Higher activity of browsing could be seen in the morning than in the afternoon. The most consumed browse species were Xuong rông (*Opuntia monacantha* Haw, cactus), Long giây (not classified), and Bôn bôn (*Calotropis gigante*), and they were also present in a high amount at the pasture.

Results from this study will hopefully contribute to an understanding of diet selection and behaviour of sheep on natural pasture. Species could be selected for reseeding and it would be possible to predict overgrazing.

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