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Research Article

Influence of Communal Area Grazing Management System on the Foraging Behaviour of Steers in a Semi-Arid Area of Zimbabwe

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ABSTRACT

A study was conducted to determine the influence of grazing management system on the foraging behaviour of steers in semiarid area of Zimbabwe. Foraging behaviour was determined through direct observations of focal animals. Four draught steers were observed in either the grazing scheme or under the traditional grazing management over the early, mid and late rainy seasons. Grazing was found to be the most dominant foraging activity under the two grazing systems. The time spent grazing was significantly (P<0.05) affected by the interaction between grazing management system and season. As the season progressed, grazing time increased for animals in grazing schemes. In grazing schemes, browsing was strongly marked during the early and late rainy seasons. The time spent by animals walking was higher (P<0.05) for steers under the traditional system. Other idling activities, such as drinking water were curtailed in grazing schemes due to the absence of watering points in some paddocks. These findings suggest that grazing schemes tended to limit foraging activities, possibly due to limited range resources. The ability of cattle under traditional grazing system to switch effectively among different patches might have contributed to their foraging activities.

INTRODUCTION

Foraging behaviour encompasses all the activities done by the animal in search of food. Some of the components of foraging behaviour that can be recorded include grazing time, biting rate and bite size (Minson et al., 1976). Foraging behaviour studies have been done through visual observation of the animals at regular intervals (Hancock, 1953). In some studies, equipment such as vibracorders (Phillips and Denne, 1988; Rook and Huckle, 1996), camcorders (Utsami et al., 2009) and GPS collars (Henkin et al., 2011) attached to the animals for automatic recording of foraging activities, have been used. While use of equipment gives accurate estimates of foraging activities, they are expensive and can be easily lost under communal grazing environments where animals can wander over long distances. Behavioural patterns displayed by the animal are useful indicators of the nutritional quality of the herbage being grazed (Dudzinski et al., 1982; Henkin et al., 2011). In addition, forage quantity and forage depletion determine foraging behaviour of animals (Laca, 2000). Therefore, grazing management systems that affect forage quality and quantity also influence the foraging behaviour of the grazing animal.

In most communal areas of Zimbabwe, traditional grazing management is practiced mainly through herding cattle during the rainy season. In some areas, grazing schemes, involving fencing of the grazing area and internally dividing the area into paddocks so that rotational grazing can be implemented as veld management practice, have been promoted. The system of rotation recommended in grazing schemes is short duration grazing. Short duration grazing is a multi-paddock, one herd grazing system involving rapid rotation of the livestock (Gillen et al., 1991). While the nutritional benefits of short duration grazing include reduction in proportions of un-grazed plants and improved livestock distribution in the grazing area (Savory, 1978), the effect on foraging behaviour needs to be determined.

Grazing schemes have been in existence in some communal areas of Zimbabwe since the pre-independent period but most work has been on their socio-economic impact (Cousins, 1987; 1988; 1989; 1996; Scoones, 1990; 1995). While grazing schemes tended to compromise the forage nutritional quality (Hungwe et al., 2013), their influence on the foraging behaviour of animals is largely unknown.

The objective of this study was to evaluate the influence of grazing management system on the foraging behaviour of steers.

MATERIALS AND METHODS

Study site

The study was carried in Gutu district of Masvingo Province, Zimbabwe. Two areas, Vuzhe and Segande, with contrasting rainfall patterns were selected for the study. Each area had a functional grazing scheme and an adjoining area where traditional grazing management was practiced. The climatic and environmental conditions of Vuzhe and Segande are described by Hungwe et al. (2013). The grazing schemes in the two areas had contrasting sizes and extents of adoption. Vuzhe consists of eleven paddocks covering about 500 ha in extent. The grazing scheme in Segande covers about 160 ha and is divided into 4 paddocks. Two seasonal streams, Nyananga and Mazare, mark the eastern and western boundaries of Segande and traverse all the paddocks.

In Segande, grazing scheme committees are entrusted to determine the rotation of animals through specific paddocks and the grazing duration in each paddock. The grazing period depended on the size of the paddock and the condition of vegetation. The location of the paddocks relative to homesteads influenced the choice of paddock to use in Vuzhe.

Under the traditional grazing system, in both areas, the grazing areas consisted of any open spaces where cattle are herded during the day in the rainy season. Each individual farmer decided independently where the cattle would be grazing on a daily basis.

Data collection

Four adult steers, from volunteer farmers willing to participate in the study, were randomly selected from the available herds to be observed for their foraging behaviour. The steers selected had experience in grazing in the respective systems. Four animals are adequate to obtain reliable estimates of animal behaviour (Hull et al., 1960).

The four focal steers, in each grazing management system, were observed by trained observers while foraging. Foraging behaviour determination was carried out during the early rainy season (December), mid-rainy season (February) and late rainy season (May). Four enumerators observed the four animals using the method of Altmann (1974). The observations were carried out for 4 successive days in each area. The recording days for the two grazing systems were chosen at random. Randomisation of observation days was done to reduce differences due to observation dates.

Each observer recorded the activities of each animal to the nearest minute for 20 minutes. Each 20-minute session was divided into five minute periods. At the end of each 20-minute period, there were 10-minute breaks to facilitate the observers rotating animals for the next 20-minute recording session. The observers rotated in such a way that by the end of the day, each would have observed all the four steers in the morning and afternoon. The foraging activities recorded were grazing, browsing, walking and resting (including drinking water).

There were no observations between 1300 and 1400 hours since normal foraging activities were temporarily disrupted as farmers herded their animals back to homesteads especially those under the traditional grazing system. In the grazing schemes, animals were only brought back from grazing areas at sunset.

Data analysis

The experimental design was a Completely Randomised Block Design with a 2*3 factorial arrangement. The factors were grazing management system and season of observation. Data was blocked by area (Vuzhe and Segande). The proportions of time spent on various foraging activities were log-transformed. Analysis of variance for each foraging activity was done using the General Linear Models procedure (SAS, 2003). Data was analysed for the effect of grazing management system, season of observation, and the interaction of grazing system and season of observation. When F-tests were significant, Least Squares procedures were used for mean separation.

RESULTS

Table 1: The effect of area, grazing system, season of observation and grazing system by season interaction on foraging activities of the steers.

	Source of Variation			
Foraging activity	Area	Grazing system	Season	Grazing X season
Grazing	*	*	*	*
Browsing	*	*	*	*
Walking	*	*	*	*
Resting	*	*	*	*

*Significant (P<0.05)

Table 1 summarises the effect of area, grazing management system, season of observation and grazing system by season interaction on the foraging activities. There were significant (P<0.05) interaction effects between grazing management system and season of observation for all the foraging activities.

Figure 1. The proportion (%) of total foraging time spent during grazing. Within an area and season, bars with the same letter are not different (P>0.05)

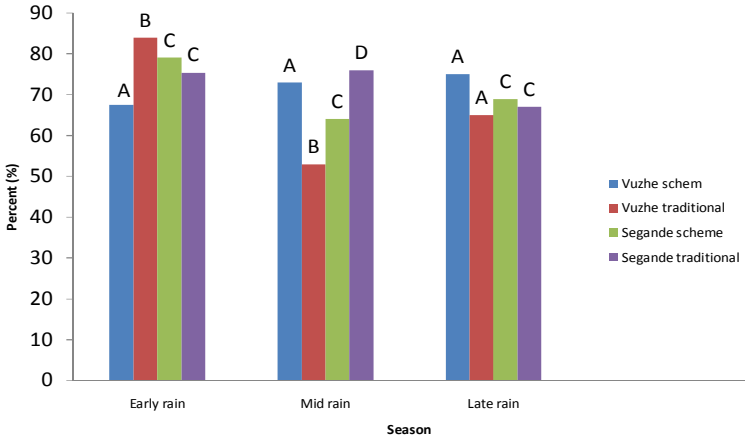
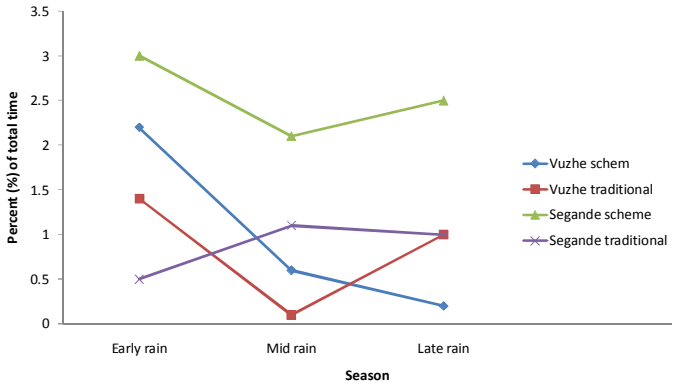


Figure 1 shows the proportion of total time spent by steers actively grazing during different periods of the rainy season. In Vuzhe, steers in the grazing scheme spent less time (67.5%) grazing than those under traditional management (84%) during the early rainy season. The time spent grazing declined drastically during the mid-season for animals under the traditional system. However, the animals in grazing scheme increased their grazing time as the season progressed. In Segande, grazing times were only different during the mid-season when animals under the traditional system grazed longer.

Figure 2. The trend in proportion (%) of total foraging time spent during browsing under the two grazing systems in Vuzhe and Segande..



The times spent by the animals browsing under the two grazing management systems in Vuzhe and Segande are shown in Figure 2. In both areas, browsing times were significantly ($P<0.05$) different with steers in grazing schemes spending more time browsing. In both areas, there was high browsing activity during the early and late rainy seasons. In the late rainy season, browsing activity increased especially for animals under the grazing scheme in Segande.

Figure 3. The proportion (%)of total time spent walking during different parts of the season. Within an area and section of season, bars with the same letter are not different (P>0.05)

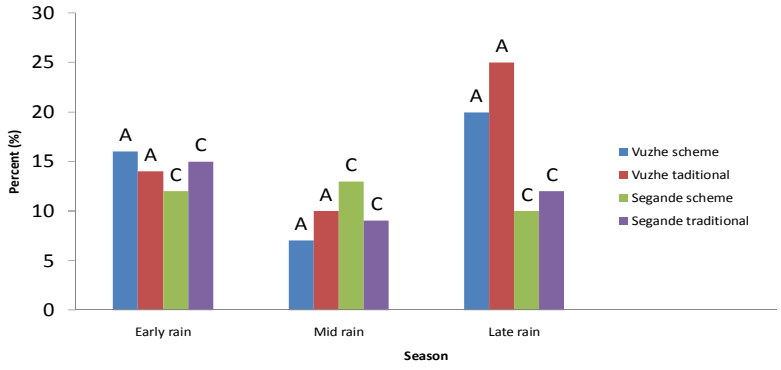
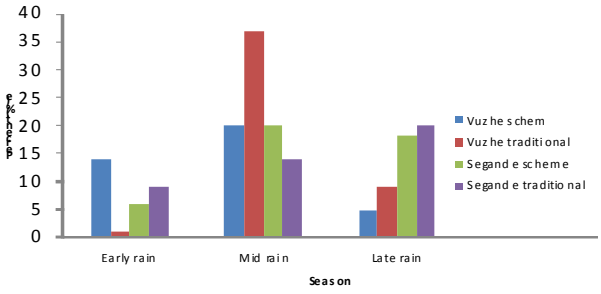


Figure 3 shows the proportion of time spent by the animals walking, without grazing or browsing. The time spent walking was significantly affected by the grazing system and season interaction. In Vuzhe, the animals spent the same amount of time walking under different grazing systems although the activity rose markedly during the late season. For Segande, the walking activity for animals under the traditional system was higher during the early season. Thereafter, the walking activity remained fairly constant into the late season.

Figure 4.The proportion (%) of total foraging time spent during resting and drinking water under the two grazing systems in Vuzhe and Segande..Within an area and season, bars with the same letter are not different (P.0.05).



The time spent by the animals resting and drinking water (Figure 4), shows that this activity rose sharply during the mid rain season for animals under the traditional system in Vuzhe. In Segande, resting and drinking by the animals was similar between the two grazing systems during different periods of the season.

DISCUSSION

The effect of area on foraging activities was expected since the study areas were located in different agro-ecological zones which differ in rainfall and temperature. In semi-arid areas of Zimbabwe, the growth of grasses varies markedly in response to the erratic occurrence of rainfall (Dye and Walker, 1987). Forage quality and quantity change with rainfall (Ash and Stafford-Smith, 1996), and these two vegetation parameters are key determinants of grazing activities (Senft et al., 1987).

In Vuzhe, animals in the grazing scheme tended to graze longer than those under the traditional system as the season progressed. Long grazing times indicate that forage quality and quantity are low (Gammon, 1976). The increase in grazing time with season was also reported elsewhere (Zoby and Holmes, 1983; Scarnecchia et al., 1985). The late rainy season coincided with low forage digestibility in the study areas (Hungwe et al., 2013). Tainton (1999) reported that as rainfall and temperature drop, feed availability declines. The animals could have responded to reduced forage availability by increasing grazing times. The sharp drop grazing time under the traditional system during the mid rainy season indicate that the animals had access to patches of high quality and quantity.

Similar grazing times during the early rainy season in Segande, indicates that the grazing conditions under the two systems were similar. During this period, forage digestibility was high (Hungwe et al., 2013). The longer grazing times in the current study compared to other findings (eg. Henkin et al., 2011) indicate inadequate forage availability (Scoones, 1990). Animals compensate for limited forage availability in this semi-arid area by increasing the time spent grazing.

The high browsing activity for animals in grazing schemes for both areas could in part be due to the presence of dominant woody plants and shrubs within the grazing schemes. The browsing activity was clear during the early and late rainy seasons. In the early season, cattle switch to browse in response to temporal flushes during this period. This finding supports the observation that green tree leaves appear early in the season before grass establishes (Scoones, 1990). Scoones (1990) reported much browsing off leaf litter during the dry season. The low browsing activity compared to the above report could be due to litter rotting since the study was conducted during the wet season. However, browsing is an important activity when grasses are dormant (Mangan, 1988) and during drought when browse is the sole feed (Scoones, 1990). Therefore, browse is important when grass availability is so marginal that daily intake requirements are severely limited. The low browsing activity compared to grazing confirms reports that browsing is not a major foraging activity for cattle (Hafez et al., 1969).

The proportion of time spent walking declined during the mid rainy season for both systems. Animals walk in order to search for food of high quality (Walker et al., 1987) or to water points. Walking long distances to watering points reduces feed intake (Manteca and Smith, 1994). The absence of water points in some paddocks in grazing schemes might have suppressed walking activity. In the mid season, forages are sufficient in quality and availability. Laca et al. (1994) reported that increased rates of forage depletion decreased times spent on grass patches. The high walking activity for steers under the traditional system indicated the presence of various grass patches to be exploited. The spatial patchiness of the grazing area

influences foraging pattern (Laca, 2008; Utsami et al., 2009). However, the patchiness across a foraging landscape forces the animal to trade off between diminishing rewards at the present patch against the cost of walking in search of another patch (Dumont et al., 1998). Short duration grazing, as recommended in the grazing schemes, results in even distribution of livestock and uniform forage utilisation (Savory, 1978). As herbage mass decline, the distribution of animals become uniform and different patches are exploited equally (Henkin et al., 2011). Low walking activity for animals in the grazing schemes could also be attributed to the physical limitations imposed by fences.

Resting activities included lying down, standing and drinking. Longer resting times as the season progressed coincided with longer rumination times (Arnold and Dudzinski, 1978) as forage quality deteriorates. Resting might, in part, reflect a strategy to conserve energy. Resting while drinking water was curtailed in grazing schemes since some paddocks had no facility for this activity. The omission of 'key grazing resources' resulted deaths of animals in pilot grazing schemes (Scoones, 1990).

Where the grazing scheme had many paddocks, individual farmer preferences on such issues as location of the paddock came into play when deciding the paddock to be grazed. While the management of grazing areas is a complex process giving rights to all citizens to use the common resource (Campbell and Shackleton, 2002), this might have compromised some normal foraging behaviour in grazing schemes.

CONCLUSIONS

Animals under the traditional grazing management system had more freedom to express their foraging activities than those under grazing schemes. Despite limited forage feed resources, cattle under the traditional grazing management system had an opportunity to forage from several grazing resources available. The absence of key grazing resources in some paddocks suppressed foraging activities such as walking in search of water. The design of grazing schemes should be modified in such a way that each paddock is self-containing to meet animal's foraging needs.

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