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Grazing management systems: Creep grazing for suckling goat kids

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Abstract. Creep grazing is a management system designed to match particular pasture forages and (or) grazing areas with specific nutritional requirements of different classes of grazing animals. It allows access of young nursing animals to forage of high quality and palatability (creep area) while excluding mature animals. The young animals through special openings (creep gates) are able to graze the creep area and return for suckling, thus possibly increasing weight gain and weaning weight without concentrate supplementation. In this paper, creep grazing by goats is described, with special attention given to considerations of the location of the creep area, creep gates and forage species. Kids' foraging behaviour and relevant management practices, with highlighting of areas deserved of future research attention, were also discussed.

Keywords. Rangeland management – Creep area – Creep gates – Mimosa tree – Goats.

Systèmes de gestion du pâturage : "Creep grazing" pour chevreaux allaitants

Résumé. *"Creep grazing" est un système de gestion des parcours qui tient compte des besoins de différentes catégories d'animaux conduits sur ces espaces pastoraux. Il permet l'accès des jeunes animaux au fourrage de bonne qualité et bien appété et empêche l'accès des animaux adultes. Les petits animaux s'infiltrent à travers des ouvertures aménagées dans les zones cibles et retournent pour allaitement, ce qui leur permet de gagner du poids et d'atteindre des poids au sevrage relativement élevés sans supplémentation avec du concentré. Cet article décrit une technique de pâturage "creep grazing" par les caprins en accordant une importance particulière à l'emplacement des zones cibles "creep areas", aux espèces fourragères, aux comportement des chevreaux et aux pratiques de gestion des parcours. Il rapporte aussi des recommandations relatives aux recherches ultérieures.*

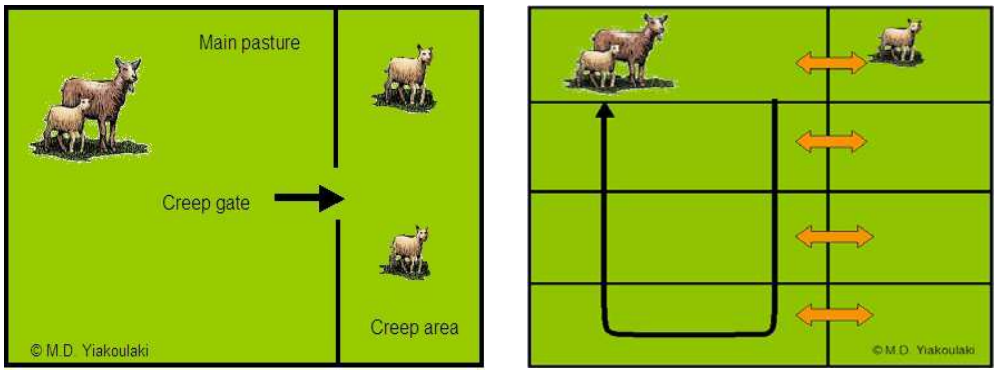
Mots-clés. *Gestion des parcours – "Creep" – Mimosa – Caprins.*

I – Introduction

Predominant considerations in the design of grazing systems have been plant-related factors such as times of growth of shoots and roots, flowering, seed maturity, germination, seedling establishment and levels of non-structural carbohydrates. Although plant survival under various environmental conditions is essential, grazing animals are generally the only means of deriving income from plant production. However, the nutritional and behavioural needs of grazing animals have not been adequately considered in the design and development of most grazing systems. Selectivity of grazing by animals for specific forage plant species and plant parts is of paramount importance for successful animal production. In general, animals select the most nutritious forage available for high levels of nutrient intake and production. However, this selective grazing creates the need for grazing systems (Kothmann, 1980).

Creep grazing is a management system designed to match particular pasture forages and (or) grazing areas with the specific nutritional requirements of different classes of grazing ruminants. It allows young nursing animals access to forage of high quality and palatability (creep area), while restricting more mature animals with lower nutrient requirements to an area with forage of lower

mass and (or) quality (main pasture or rangeland area). The suckling offspring are with their mothers in the main pasture, either in a continuous (Fig. 1a) or rotational grazing basis (Fig. 1b), but have access to the creep area as well (Vallentine, 1990). This can be achieved through special openings in the fence (creep gates). Young animals grazing in the creep area are able to maximally express forage preferences and selectivity, typically with most palatable plants of highest quality being consumed. Thus, because of elevated nutrient intake compared with restriction to the same area of the dams, growth rate and weaning body weight can be improved without concentrate supplementation. Moreover, in addition to the cost of purchased feedstuffs, concentrate supplementation of kids pre-weaning does not always improve performance (Goetsch *et al.*, 2002). Stress associated with weaning is possibly reduced by creep grazing, and with well managed creep grazing systems carrying capacity can be improved with relatively small increases in production costs (Rice *et al.*, 1987; Ritchie, 1987).



(a) (b)

Fig. 1. Diagram of creep grazing in continuous (a) and rotational (b) grazing systems.

The main advantages of using creep grazing are the relatively high nutritional requirements and potential for growth of suckling animals and variability in the quantity and quality of forage available throughout the growing season, which are often low. Often suckling animals are unable to compete with their mothers to maintain intake at lower herbage allowances (Baker *et al*., 1981). Moreover, the use of low grazing pressures to favor the suckling animals is impractical because of herbage wastage and low animal production per unit land area (Blaser *et al.*, 1974).

Most research attention given to creep grazing has been for increased weaning weight of beef calves (Ritchie, 1987; Prichard *et al.*, 1989). Creep grazing is a relatively old concept for which interest has been recently increasing. However, creep grazing by small ruminants has not been extensively investigated, and only a small number of publications are readily available. The effect of creep grazing on lamb weaning weight was studied by Adandedjan *et al*. (1987) and Yiakoulaki *et al.* (2007) addressed influences of creep grazing compared with different stocking rates on performance of meat goats does and kids. The primary aim of the present paper is to describe creep grazing, particularly as it pertains to suckling goat kids, and to highlight research needed to achieve most efficient creep grazing systems.

II – Location of the creep area

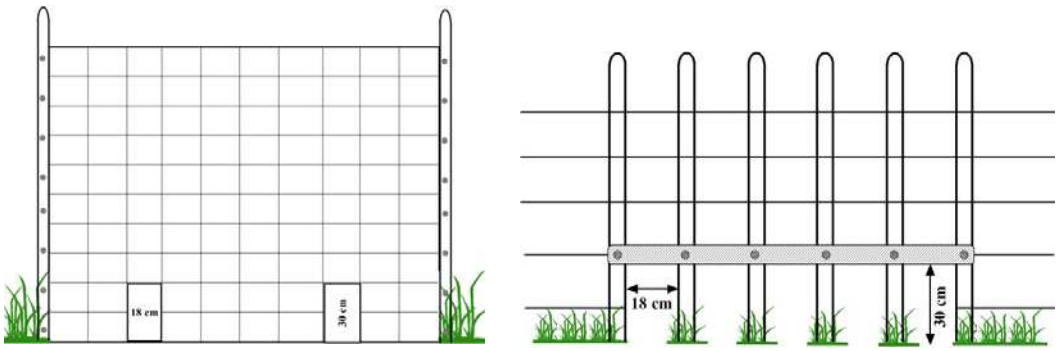
Several factors should be considered in selecting the location of a creep area, such as topography, site and size. In continuous grazing system, the creep area is adjacent to the main pasture. The ideal arrangement is to have two parallel pastures with one common fence (Fig. 1a). Both does and

kids have continuous access to the main pasture but only kids can enter the creep area. In most cases kids have continuous access to the creep area but limited or periodic access is also feasible. In rotational systems, where the pasture is divided into paddocks, each paddock should be accompanied by a separate area (Fig. 1b), although access to one large creep area is also possible.

It is desirable for the creep area and (or) access point to be located where the animals frequently travel or congregate, as well as being close to a housing/handling facility to facilitate management. The size of the creep area depends on the forage production and the stocking rate. If high quality forage is abundant in the main pasture, such as with low stocking rates, then kids will have a relatively low tendency to use the creep area. If the main pasture consists of low quality forage and (or) has low forage availability due to a high stocking rate or low rainfall, kids will use the creep grazing area extensively and maximal benefits will be realized.

III – Creep gates

Any type of opening large enough for offspring to pass through but small enough to restrict passage of larger animals (i.e. does) to the creep pasture can be used as a creep gate. Creep gates are usually located in a readily accessible area, without barriers (stones, woods, tall plants) in front of them, and near shade, water or mineral feeders. Creep gates can be made by cutting small openings in woven wire fence between the main pasture and the creep area, or simple openings in the fence can be constructed with posts (Fig. 2). Creep gates of 18 cm wide and 30 cm high (above the ground) allow entry to the goat kids but not to the does. Electric fences are also effective and easy to use. Creep area access can be achieved by raising the electric fence high enough to allow kids to walk under but low enough to restrict doe entry. Initially, suckling kids may be reluctant to leave their mothers and move through a creep gate. Thus, water and salt can moved in the creep area to attract them. Kids quickly learn to use a creep area if availability and palatability of forage are greater than in the main pasture.



(a) (b)

Fig. 2. Creep gate constructed by simple openings in the fence (a) and by posts (b).

IV – Forage species for the creep area

The foliage of trees and shrubs is an important source of nutrients for small ruminants, especially during seasonal deficits in feed quantity and nutritive value (Topps, 1992; Pamo *et al.*, 2006). Goats have high preference values and exhibit considerable selectivity for specific plant species, typically of high nutritive value, compared with sheep and cattle (Papanastasis *et al.*, 2007). Thus, both

natural and cultivated browse plants can be used for creep grazing by goats, which would presumably improve growth rate during and body weight at the end of the suckling period. Furthermore, goats typically consume a diverse diet in terms of botanical composition when many plant species are available. So, cultivated leguminous trees, in combination with natural forage plant species in alley cropped grazing systems, may provide a sustainable means of creep grazing to improve growth performance of suckling meat goat kids (Yiakoulaki *et al.*, 2007).

Forages well adapted to local conditions and of high digestibility and crude protein content are well suited for creep grazing. For example, mimosa (*Albizia julibrissin* Durazz) is a tree species introduced in the USA as an ornamental plant from temperate and subtropical regions of Asia. It can produce 3.8 tons of foliage DM/ha (Bransby *et al.*, 1992), averaging 21.3% crude protein and 69.3% *in vitro* dry matter digestibility (Bransby *et al.*, 1995). Mimosa has been evaluated as a potential tree legume that can be incorporated into production systems to provide high quality forage for small ruminants (Bransby *et al.*, 1995; Addlestone *et al.*, 1999; Luginbuhl and Mueller, 2000; Animut *et al.*, 2007). The effect of mimosa for creep grazing of goat kids on mixed grass-forb pastures in the summer in Oklahoma, USA, was recently studied by Yiakoulaki *et al.* (2007). In that experiment, mimosa trees were in rows separated by 3.1 m with 0.46 m between trees. Before grazing started, the trees were pruned at a height of 0.6 m to promote branching, although Animut *et al.* (2007) suggested that this practice might not in all instances increase mimosa leaf growth. However, for access of suckling kids to all mimosa leaves, pruning may be beneficial. Goat kids readily consumed the foliage of mimosa and performed satisfactorily. Besides mimosa, other multipurpose leguminous trees such as black locust (*Robinia pseudoacacia* L.), tree medic (*Medicago arborea* L.) and white mulberry (*Morus alba* L.) providing high quality foliage consumed readily by goats (Addlestone *et al*., 1999; Papanastasis *et al.*, 2007) could be used for creep grazing.

V – Foraging behaviour of kids

Goats select particular plants and plant parts that are higher in nutritive value than the average of available forage in pastures and avoid harmful ones, thus expressing "nutritional wisdom" (Provenza and Balph, 1990; Provenza, 1995). Nutritional wisdom is the result of genetic transmission (Cooper *et al*., 1988), training or transfer of knowledge primarily from the dam to kid during the suckling period (Thorhallsdottir *et al*., 1987) and learning through trial and error. Specific production conditions influence relative importance of these influences. The experiment in Oklahoma previously mentioned provides an example of this. Bermudagrass (*Cynodon dactylon* L.) and johnsongrass (*Sorgum halepense* L.) were the major grass species and ragweed (*Ambrosia artemisifolia* L.) was the primary forb selected in both grazing areas. The kids selected a diet when in the main pasture without mimosa of 81% grasses and 19% forbs. But, when in the creep area, mimosa was 53% of the diet consumed by kids, with lesser contributions of grasses and forbs (i.e. 23 and 24%, respectively; Yiakoulaki *et al*., unpublished data). Because kids had not been previously exposed to browse plant species and does were not present in the creep area with kids, learning through trial and error was the major means by which mimosa was selected, with an ability present to recognize mimosa leaves as of high nutritional value.

Biting rate is an important variable in grazing ruminants. Frequently, in growing, mature and lactating ruminants, management practices induce complete or partial compensatory changes in bite size or mass, biting rate and grazing time. It is likely, however, that relationships among these behaviours in suckling ruminants are different than in animals after weaning because of the varying contribution to nutrient intake of milk pre-weaning. It could be postulated that forage characteristics have relatively greater impact on biting rate by suckling than non-suckling ruminants. In support, in the Oklahoma goat creep grazing study noted earlier kids when grazing in both the main pasture with does and in the creep area had a higher biting rate (bites/min) for ragweed and bermudagrass than for mimosa (only in creep areas) and johnsongrass (Table 1; Yiakoulaki *et al*., unpublished data). In accordance, Phister *et al.* (1989) reported a low biting rate with woody plant species. The low biting rate for johnsongrass could be explained by its very long leaves.

Table 1. Biting rate (bites/min) ±SE for predominant forage species selected by goat kids (Yiakoulaki *et al.*, unpublished data)

Mimosa	Ragweed	Bermudagrass	Johnsongrass
19.1 ± 1.21[a]	26.8 ± 3.37[b]	28.1 ± 2.19[b]	15.1 ± 2.87[a]

[a,b]Means without a common letter differ (P ≤ 0.05).

VI – Management practices affecting creep grazing

The stocking rate can have marked impact on grazing animal production and influences responses to creep grazing. Yiakoulaki *et al.* (2007) reported some benefit from creep grazing on the average daily gain (ADG) of both does and kids when stocking rate on the main pasture was high; kid ADG was 81 and 37 g for creep grazing and the high stocking rate treatment, respectively. However, ADG of does and kids were similar between creep grazing and low stocking rate treatments. Choices between creep grazing and an increased size of the main pasture would obviously be dictated by the total area available. With limited land, a presumably smaller total area required for creep grazing would be an advantage, particularly if the creep area was fertilized to increase forage growth. From an efficiency of forage utilization standpoint, creep grazing also would be preferred since overall efficiency of energy metabolism is greater with direct nutrient intake by kids compared with increased doe milk production and consumption by kids.

The management of creep areas after grazing should also be considered in a rotational creep grazing systems. If the creep area is large and only a moderate to low amount of forage is removed by kids, immediate subsequent grazing by animals with lower nutrient requirements may be desirable to promote forage regrowth and minimize stage of maturity in the next grazing period. A creep grazing area size that closely matches the number and weight of kids would reduce the need for such "follow up" grazing but could restrict the potential for forage selection by the kids.

A significant issue for both continuous and rotational creep grazing systems involving leguminous trees is the mass of tree leaves available in relation to the number and weight of kids and grazing duration. In the study of Yiakoulaki *et al.* (2007) and previous ones with these pastures (Animut *et al.*, 2007; Goetsch *et al.*, 2007), goat kids having a continuous access to the creep area completely removed the leaves of mimosa in the first few days of grazing. Hence, limited access, perhaps every other or third day or for a few hours each day, would be a consideration to achieve continual tree leaf intake. Alternatively, subdividing creep grazing areas into very small areas for short term sequential grazing throughout the entire grazing season or greater numbers of trees through a higher planting density or larger creep area are other possibilities.

VII – Conclusions

Creep grazing offers potential to enhance performance by suckling goat kids under conditions of limited forage mass and (or) quality in the area does are restricted to. The combination of cultivated multipurpose leguminous trees with naturally occurring grasses and forbs in alley cropping grazing systems can be used for creep grazing by goats. However, further research is needed to determine most appropriate means of managing creep areas in rotational grazing systems after access by kids; to develop methods to achieve continuous availability of leguminous tree leaves to creep grazing kids; to define specific forage conditions conducive to maximal benefits from creep grazing; and factors to consider when choosing between creep grazing and an increased size of grazing area for both does and kids.

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