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Role of Grazing Cattle on Seed Dispersal of Plants in a Hill Pasture 3. Seasonal Variation of Locations of Defecation by Cattle and its Effects on Germination of Seeds in Dung Pats

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The 21st International Grassland Congress / 8th International Rangeland Congress took place in Hohhot, China in 2008.

Edited by Organizing Committee of 2008 IGC/IRC Conference

Published by Guangdong People's Publishing House

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Role of grazing cattle on seed dispersal of plants in a hill pasture 3 . seasonal variation of locations of defecation by cattle and its effects on germination of seeds in dung pats .

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Key words : dung pats , environmental condition , grazing cattle , location , seed germination

Introduction Plant propagule dispersal by grazing herbivores is dependent on animal movements and defecation patterns in the landscape . Location of seed-laden dung can affect seed germination and plant establishment due to heterogeneous environmental conditions (e.g . , solar radiation and moisture conditions ; Akber *et al .* 1995) . In this study , we investigated the effects of spatial and seasonal variation in a grazing pasture on seed germination rate and seedling survival of seeds embedded in dung pats .

Materials and methods

Seasonal variation of the location of defecation by grazing cattle Two experimental areas (Area I and II , 200 m×4 m each) were selected within a 30 ha paddock where 69-115 cows with 38-46 calves were rotationally grazed . Soil type is nonallophanic Ando soil , and vegetation in both areas was similar except Area II included 42 .5% in coverage of broad-leaved forest . After the grazing period in May , August and October in 2005 , the degree of shading (i.e . , lenient shading (LS) ; shading proportion of shading area by plants was <25% , medium shading (MS) ; 25-75% and heavy shading (HS) ; >75% and dominant plant species were recorded for all fresh dung pats in each area .

The effects of environmental condition of dung on seed germination rate and survival of the seedlings *Trifolium repens* , *Poa pratensis* and *Zoysia japonica* seeds were mixed with dung of a single dairy cow fed grass silage (neither anti-parasitic medication nor ionophores were dosed) , respectively (1 500 seeds/1 200 g of fresh dung pats , n=3) . The dung pats (φ=20 cm) were placed on a pasture , after cutting the sward to a height of 3 cm . Two treatments ; i.e . , sunshine (SUN , photosynthetic photon flux density (PPFD) = 667 μ mol/s · m²) and shading (SHA , PPFD was controlled to be same as understory of the forest ; 16 μ mol/s · m²) were established , and the number of germinating seeds and seedlings mortality were recorded from 21 June to 5 September , 2005 , at a 7-10 days interval . The temperature and moisture condition in the dung were monitored using WatchDogTM sensors and data loggers (Model 400 ; Spectrum Technologies , Inc .) .

Results and discussion While most dung pats were located in sunny place (LS ; 62-91%) , the proportion of HS increased in August (17%) compared to June (3%) and October (0%) . This was due that cattle rested and defecated in shaded areas such as forested locations to avoid high daytime temperatures in summer (Yasue *et al .* , 2000) . Variation of temperature in the dung pats was drastic and maximum value exceeded to 40 C in SUN in daytime ; whereas , variation was moderate in SHA . Moisture content in dung also drastically changed in SUN in association with precipitation , whereas that in SHA was almost saturated over the experimental period . Seed germination rate was greater for SUN than SHA in all plant species (Figure 1) , however , most of the seedlings died during the experimental period in both treatments . This was probably due to high temperature in SUN and deficiency of solar radiation in SHA .

Conclusions Location of dung pats severely affects environmental conditions in the dung and therefore plant propagule conditions . The results suggest that both sunny and shading places are inappropriate to establishment of seedlings of the herbaceous plants . More moderate shading created by tall grasses surrounding a dung patch may provide proper environmental condition for seedling establishment .

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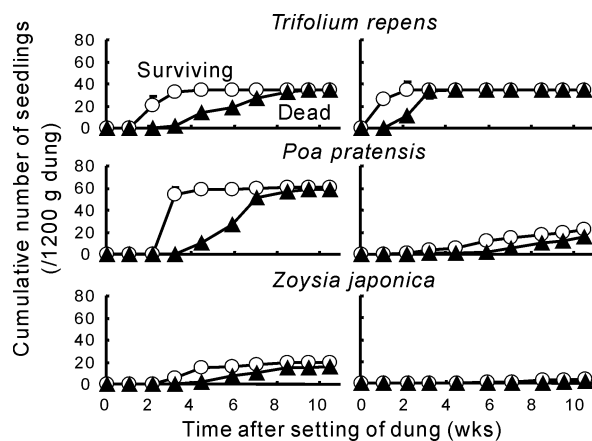


Figure 1 Cumulative number of seed germination (○) and death (▲) of seedlings in SUN (left) and SHA (right) .