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The Evaluation of Grazing Environment Condition: The Scales, the Slopes and the Ground Condition of Grazing Pasture

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Abstract

In a present paper, we reviewed some of the welfare concerns about grazing condition. It was thought that the largest scale of the grazing environment had to consider the range where the animal moved. On the other hand, the smallest scale of grazing environment might be needed to consider the inter-individual distance of animals. The slope of grazing environment might be considered advantageous because of the exercise provided. However, high sloping areas seem to be avoided as resting area and the sloping pasture with little resting area is not a good choice when trying to provide an adequate environment. The ground conditions of crowding area should be controlled by the location of amenities. We thought that the standards for cattle management should include ample evaluation of grazing environment and these information would be necessary to determine appropriate standards for grazing environment.

1. Introduction

In 1985 in Austria, Bartussek proposed a comprehensive evaluation standard of farm animal welfare called the Animal Needs Index (ANI). In the early 1990s, a more detailed and specific version was developed by several working groups. In 2000, ANI for cattle, "ANI 35L/2000-cattle," and in 2001, ANI for laying hens, "ANI 35L/2001-laying hens," were completed, and these are becoming a European standard of farm animal welfare. The standard for cattle, which has many guidelines for assessing the housing environment of cattle, is classified into 5 categories : (1) affording movement and locomotion, (2) affording social interaction, (3) type and condition of flooring, (4) light and air condition and (5) stockmanship. On the other hand, the guidelines regarding the grazing environment are very rough, listing only the number of pasturage days and the amount of pasturage time. The grazing environment provides the animals with not only freedom and amenity but also asperity, so we believe standards for cattle management should include ample evaluation of grazing environment. In this paper, we reviewed some of the major welfare concerns for cattle in a grazing environment.

2. The scale of the grazing environment

The provisions of feeding and resting are the most important elements for farm animal welfare. Especially in the case of grazing, little assistance is needed from stockperson, so it is necessary to think about the scale of the pasture or the location of amenities such as watering places and shade.

When considering the scale of pasture or the location of amenities, the nature of the locomotion of the animal would be important. There are many reports about the distance cattle can walk. Arnold and Dudzinski (1978) reported that the distance per day was 0.9-12.6 km, while Suzuki *et al.* (1984) reported that it was 3 - 5 km. It is likely that the season or the scale of the pasture affected these distances. Krohn *et al.* (1992) reported that the distance in summer was 2.5 km and in winter it was 0.8 km in a 10-ha pasture. Shepperd (1921) reported that the distance in a 12-ha pasture was 2.7 km per day and in a 260-ha pasture it was 8.9 km. In addition, Frazer and Broom (1990) reported that though the distance was 0.9 km

in a 0.1-ha paddock, it was 24 km in range pasture in the dry season. They suggested that the distance was influenced by the location of food and water, and that the quality of grass was a stronger factor than the quantity of grass, milking stage, the body condition, or season. The evaluation of the scale of pasture will change whether the walking distance is considered as a "locomotion load" or "behavioural freedom." However, the distance reported by Frazer and Broom might be too long as an optimal distance, though it could be thought of as a walking potential.

Suzuki *et al.* (1984) suggested that if there were one shade in 10 ha or100 ha, it would be enough because the daily walking distance of cattle is 3 – 5 km. However, they were assuming the pasturage was in flat land. This distance must be shorter in our country, which has many mountainous areas. Holechek *et al.* (1995) suggested that the distance to a watering place should be less than 3.2 km in flat land, less than 0.8 km in wasteland and less than 1.6 km in hilly and sandy land. Sugiyama (2001) reported that the distance between walking areas per day was 462 m (walking area per day : 14.1 ha) in a mountainous area. Although she had not shown the tracks in a walking area where cattle moved, we concluded that the reported distance might be restrained because of the area being mountainous. Furthermore, the walking ability of calves was reported as 12 m per 30 min during the first week after birth and only 80 m per 30 min during the 2nd month (Frazer and Broom.1990). Therefore, it is necessary to consider the following load of calves when we evaluate the grazing environment of a breeding farm.

On the other hand, there are few reports on the minimum scale need for a grazing environment. Krohn *et al.* (1992, 1994) reported that cattle willingly use a pasture, and the provision of a pasture decreased abnormal behaviour such as bar-biting in the cow shed. Thus, the provision of pasture could be considered a beneficial element for cattle management. However, these open space provisions have to be satisfactry both quantitatively and qualitatively. Quantitative needs relate to the space occupation, social distance and flight distance. Qualitative needs relate to space-dependent activities such as eating, exploration, body care, kinetics and social behaviour (Frazer and Broom.1990).

The inter-individual distance of milking cow kept in intensive pasture was reported to be 8.8 m, and it was 9.2 m in extensive rangeland in Australia (Frazer and Broom.1990). When cattle lie down, most of them keep within 2-3 m of one another compared with 4-10 m when they graze. Furthermore, the distance broadens to a 25-m radius when a bull is present (Frazer and Broom.1990). In the Dairy Housing and Equipment Handbook (1976) of the United States, It has been recommended that the area need for a cow to move is 4 – 7 m^2 or 7 – 10 m^2 and the area need to lie or rest is 3 – 7 m^2. On the other hand, that of the United Kingdom is 9 – 12 m^2 (Wilson.1978). Based on these results, Kondo *et al.* (1986) studied the relationships of the herd structures to environmental factors. They indicated that the herd structure at the feedlot could be kept until 30 m^2/ cow like that at the grazing pasture. In addition, Sato *et al.* (1976) suggested that the herd would spread out as the herd density grew, and the cohesiveness of the herd tended to decrease when the herd density reached 35 a – 40 a / 4 cow. These results might serve as a reference when we consider the optimal scale for the grazing herd.

3. The slope of the grazing environment

Unlike many flat grazing lands in Europe, our country has many mountainous areas, so it is hard to exclude sloping area from the grazing land. Thus, the effect of slopes as part of the grazing environment must be considered. Mountainous area or sloping areas were considered better for animals than more gently sloping pasture or flat land in ANI (Bartussek *et al.* 2000), because they provide better exercise for the skeletal apparatus and circulation of the animals. Sawazaki *et al.* (1974a) reported that the width of body width and the skeletal apparatus of the store cattle farmed in mountainous area was better developed than that of cattle farmed in flat area, though they generally finished smallish. Furthermore, the effect of slopes heightened the resistance to diseases (Sawazaki *et al.*1974b), activated the metabolic and circulatory system and improved animals' oxygen-use-efficiency. As a result, the growth rate, the dressed carcass percentage, the marbling, the subcutaneous fat thickness and the rib-eye area was better in these cattle than in those raised in a flat area (Sawazaki. 1975). Henderson *et al.* (1966) reported that the exercise occurring in flat pasture accelerated metabolism through the

cardiorespiratory training, and Kido and Hayashi (1999) indicated that type I muscle fiber, which indicates high fat storing ability in fattening periods increased, increased at the superficial part of longissimus muscle, the rectus femoris muscle and the semimembranosus muscle, so raising cattle on sloped grazing land might be considered advantageous because of the exercise provided.

On the other hand, there are many reports that animals have a disadvantage with respect to resting area. Yasue *et al.* (1997) showed that resting behaviour of cattle was observed between 0 and 15 degrees of slope and was never observed when the slope was over 25 degrees. Ganskopp and Vavra (1987) suggested that grazing cattle avoided slopes over 30 % (about 16–17 degrees) . Mueggler (1965) reported that cattle used a 750–m radius area from the bottom in the 10 % sloping pasture, whereas they used only 30–m radius area from the bottom in the pasture with 65 % slopes. In addition, Yagi *et al.* (1983) estimated the energy expenditure by cattle in a mountainous pasture that included many slopes (under 6 degree : 65 %, 6 to 12 degrees : 20 %, 12 to 16 degrees : 15 %) and reported that the energy expenditure in the mountainous pasture was 1.9 to 2.4 times as large as that in the flat pasture. Thus, it is necessary to consider that slopes may require twice as large an energy expenditure as that of flat land.

Ide *et al.* (1998a, b) reported that in 0 to 6 degrees of slope, the cattle could move relatively freely, and in slopes up to 12 degrees cattle could move without cattle tracks. When the slope is 12 to 16 degrees, cattle tracks occur and their use is heightened. In slope of 16 degrees or more, the walking area was approximately limited to the cattle tracks. The gradient levels of the cattle tracks in high sloping area have been reported as less than 5 degrees (Oikawa *et al.* 1981), 0 to 6 degrees (Kamata *et al.*1981) and 2 to 4 degrees (Arnold and Dudzinski. 1978) and were nearly equal to the levels with high behavioural freeness reported by Ide *et al.* (1998 a, b) Therefore, the gradient levels up to 5 or 6 degrees might be appropriate to ensure cattle's behavioural freeness. Generally, high sloping areas seem to be avoided as resting area and the sloping pasture with little resting area is not a good choice when trying to provide an adequate environment.

4. The condition of the ground in the crowding area

The ground conditions of the resting area or crowding area are very important for the cattle–housing environment. In ANI (Bartussek *et al.* 2000), the slipperiness and the structural problems causing hoof injuries were evaluated as negative factors, and wet and muddy conditions of the floor at the outdoor area of the cowsheds restricted the locomotion of cattle and aggravated hoof diseases. Thus, the ground condition is very important.

It is well known that cattle often use the area around the watering place as a resting area (Arnold and Dudzinski.1978, Yasue *et al.*1999). These areas become muddy because they are wet and the ground becomes churned up by the cattle (Sato *et al.* 2002). In addition, the excreta of cattle accumulate around the watering place or resting area (Ide *et al.* 1998a, b, Yasue *et al.* 1993), making these areas unsanitary and contributing to mastitis and hoof diseases (Sato *et al.* 1995, 2002). Fisher *et al.* (2003) reported that the percentage of lying time is 20 % less in muddy areas than in general grazing pasture, and they indicated that the muddy ground was avoided for this purpose. These crowding areas could be controlled by the location of the watering place or the shade (Ganskoopp.2001, Inoue *et al.* 1969, Sakurai and Dohi.1988). Thus, the size of dirty area can possibly be decreased by spreading the location of these amenities.

5. Conclusion

The extensive beef production system of grazing has attracted a great deal of attention in both developing and developed countries recently from the viewpoint of environmental protection, amenity and animal welfare. However, there are few evaluations and standardizations like the ANI dealing with grazing conditions compared with many codes regarding housing condition, slaughter and transportation in various countries. This might be because it is thought that grazing is already an enriched condition. However, the negative elements described in this paper must also be taken into consideration. We have reviewed some of the welfare concerns about grazing condition in this paper. It might be possible to compose a standard of grazing environment. However, there are other issues about the grazing environment and there are not many

studies to consult. We believe that more information about climate, the vegetation type, location of the shade or the shelter and the degree suffering of the ectoparasites and the transient-biters is also necessary to determine appropriate standards for grazing environment.

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