

Studies on preventing sika deer (*Cervus nippon*)  
invasions in grasslands with vision characteristics  
of the animal

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学 位 論 文 要 旨	
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題 目	Studies on preventing sika deer ( <i>Cervus nippon</i> ) invasions in grasslands with vision characteristics of the animal (シカの視覚特性を利用した草地への侵入防止に関する研究)
<p>Crop damage caused by wild birds and animals is becoming increasingly serious every year. Recently, the sika deer invasion of grasslands and the consequent damage to pastures has become a matter of concern. In this study, 1) the current damage to grasslands caused by deer was determined, 2) visual characteristics of the deer (color vision, visual acuity, and field of vision) were investigated based on behavior, and 3) a fence was devised to prevent sika deer invasion based on their characteristics and the effectiveness of this fence was evaluated during its installation in the grasslands.</p> <p>1) When no measures were implemented to prevent sika deer invasion in a meadow of 2 ha, the average number of sika deer observed per day during the summer and winter grass cultivation periods were 7.4 and 11.1 heads, respectively and the reduction in grass yield during these periods were 89% and 99%, respectively. Hence, electric fences were installed. During the summer period, the average number of sika deer and reduction in grass yield were lower (1.1 heads and 32%, respectively). In contrast, sika deer invasion showed an increase during the winter period and reduction in grass yield reached 99%.</p> <p>2) Visual acuity and color vision of sika deer were tested by operant conditioning. They had a visual acuity of 0.16 and were unable to distinguish yellow from green-yellow (the color of grass stover); however, they could distinguish blue, green, red-purple, and white among others from green-yellow. The weight, height at the top of the head, and body length of the sika deer were 29–40 kg, 97–109 cm, and 65–75 cm, respectively. Sika deer can jump over net fences measuring 120 cm in height and obstructions measuring 210 cm in depth. The visual field of sika deer related to the recognition of forward obstacles extends downwards from their eyes, suggesting that they acquire visual information necessary to jump over obstacles while approaching the fence by adjusting their head position immediately before jumping. Based on these findings, a combination of cord fences (height of 5-cords; 20, 40, 70, 100, and 140 cm) at a distance of 30 cm in front of a 120 cm high net fence, which the sika deer could jump over, was devised. This regulated their jumping behavior.</p> <p>3) Net fences with a height of 120 cm were installed behind the electric fence, similar to the ones mentioned above in point number 1). There was no invasion by sika deer and no feeding damage to grass during the summer and winter cultivation periods around a 500 m perimeter of the meadow of 2 ha. Moreover, there was no damage to the fences, as is often the case when electric fences or wire net fences are alone installed and the cost of the materials was approximately halfway between that of electric fences and wire net fences.</p> <p>In conclusion, a combination of electric and net fence effectively prevented sika deer invasions in grasslands with long lasting effects.</p>	