



Sward botanical composition and sward quality affect the foraging behaviour of free-range laying hens



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ABSTRACT

In a two-year experiment, we investigated the influence of sward plant species composition (sward type), stocking duration and state of sward degradation on the foraging behaviour of chickens. Laying hens (ISA Warren) were pastured on 15 sward types including 14 monocultures of grassland plant species (nine grasses and five forb species) and one mixed sward of the 14 species for three levels of stocking duration (one, two and three days). The behavioural traits pecking plants, ground pecking and scratching were recorded by scan sampling. Sward type had a significant effect on scratching, plant pecking, and total sward-directed pecking (plant and ground pecking together) in the grass swards ($p < 0.01$), and on ground pecking in the forb swards ($p < 0.05$). With prolonged stocking, the frequency of ground pecking significantly increased, whereas that of scratching, plant pecking and total sward-directed pecking significantly decreased. There was a significant stocking duration \times sward type interaction for all of the observed behaviours ($p < 0.01$). The tested sward types differed strongly with respect to the extent of degradation resulting from the fixed levels of stocking duration. Sward degradation as measured by percentage ground cover of green leaves or stolons and stems had a significant effect on ground, plant and total sward-directed pecking in forb swards ($p < 0.001$). Considering the observation of other studies that the presence of vegetation and a good use of the run benefit animal welfare by reducing the incidence of feather and injurious pecking, the results of this study may be relevant for the design and management of swards for laying hens outdoor runs and for a welfare-oriented optimization of husbandry systems.

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1. Introduction

Providing animals with access to an outdoor run is a fundamental constituent of organic chicken husbandry and a prerequisite for the production of eggs labelled as 'free-range'. It is important that the run area is covered with green vegetation since, amongst other benefits, vegetation cover reduces both soil erosion and nutrient leaching which results from the significant amounts of manure deposited

on the run area (Kratz et al., 2004; De Baets et al., 2006). Furthermore, the provision of an outside run covered with plants has been shown to have beneficial effects on animal health and welfare. Shimmura et al. (2008) have recorded a reduced incidence of feather and injurious pecking when laying hens had access to a range covered with clover, and Mahboub et al. (2004) observed better plumage condition with increasing time spent on grassland. Lambton et al. (2010) and Bestman and Wagenaar (2003) have found a reduced incidence of feather pecking in flocks with a good use of the run area, which was ascribed primarily to a reduction of stress levels due to lower animal densities. The vegetation cover of the outside run can also be viewed

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as a type of enrichment (Jones, 2002). Environmental and foraging enrichment has been shown to reduce injurious and feather pecking (Sherwin et al., 1999; McAdie et al., 2005). Previous studies have accumulated evidence that chickens spend approximately the same time budgets on pecking in barren as in enriched environments; in barren environments, however, due to a reduction of time spent on foraging-related pecking behaviour (e.g. litter, ground or food pecking) the animals more frequently re-direct pecking towards their conspecifics (Blokhuys, 1989; Steinfeldt et al., 2007). Reduced feather pecking may also result from intake of forage from pasture. Fibre-rich or low-energy diet has been found to reduce cannibalism and mortality (Hartini et al., 2002; van Krimpen et al., 2009), which may be caused by an increased time spent on feed intake (van Krimpen et al., 2008; Jordan et al., 2010).

Considering these benefits of the vegetation cover for animal health and welfare, surprisingly few studies have investigated the relevance of the quality and the botanical composition of the sward on chicken behaviour. Studies evaluating different types of vegetation for chicken runs have so far focused on various other aspects. E.g., the functionality of plants providing shade and shelter has been taken into account for the design of structures that would make a larger proportion of the flock use the outside run and spread more evenly over the total area (Dawkins et al., 2003; Zeltner and Hirt, 2008). Besides, the effects on quality of poultry products resulting from herbage intake (Ponte et al., 2008; Horsted et al., 2010; Anderson, 2011), and the nutritive and metabolizable energy value provided by herbage (Antell and Cizuk, 2006; Horsted and Hermansen, 2007) have been the main subject of research on the choice of plants for greening chicken outside runs.

The pecking behaviour of chickens is guided by the colour, texture and structure of the object or feed (Jones et al., 2000). Nutritional requirements have been shown to explain the choice and the amount of feed intake in layers (Horsted et al., 2006). For ground pecking and scratching behaviour, Petherick and Duncan (1989) have found significant differences in substrate choice when chickens were provided with substrates of different particle size and structure. As different species of plants come in a variety of shapes and sizes and differ with regard to their chemical composition, it may be that the pecking and scratching behaviour of chickens varies in response to the botanical composition of the pasture sward, and also in response to the percentage canopy cover of green foliage. In addition, although this aspect has as yet not been investigated, we assumed that chickens may also adapt their pecking behaviour in response to the freshness and palatability of the pasture; it has been shown that ruminants avoid patches of pasture contaminated with faeces (e.g. Cooper et al., 2000; Fleurance et al., 2007; Smith et al., 2009). Therefore, we hypothesized that sward degradation as caused by prolonged period of grazing reduces the foraging behavioural activity of laying hens.

The target of the present study was to analyze the effect of plant species composition (sward type) and of sward quality in terms of state of degradation on the foraging behaviour of chickens. In a field experiment, laying hens were taken to pasture at three standardized levels of

stocking duration on monoculture swards of fourteen different herbaceous plant species and one mixed sward. The frequency of the behaviours scratching, pecking plants, and ground pecking was recorded, and the effect of sward type, stocking duration and state of degradation of the sward on these variables was analyzed. We aimed to identify properties of the run cover which trigger high activity levels in terms of behavioural interaction with the sward. The results were intended to deliver a basis for the improvement of design and management of outdoor runs for laying hens.

2. Materials and methods

2.1. Subjects and housing

The study was conducted in 2009 and 2010. In both years, sixty non-beak trimmed laying hens (ISA Warren) were used for the experiment; different flocks were used in the two years. The animals were purchased in July 2009 and in May 2010 at the age of 18 weeks from different flocks within one organic farm. In both years, the animals were randomly assigned to 15 groups of four animals and individually marked with coloured rings.

When not on pasture, the animals were kept as one group of 60 animals in a roofed outdoors pen of 3 m × 15 m and a height of 4 m equipped with perches and nests and with sand as ground cover. The pen had solid walls at two sides (one on the short, and one on the long side); the other two sides were made of wire mesh fence covering the complete height of the pen. One half of the pen area (3 m × 7.5 m, solid walls at two sides), where the nests, perches, feeders and the water fountain were located, was roofed with light green plastic foil; the other half of the pen was roofed with wire mesh. Temperature in the pen was at ambient air temperature. The animals were provided ad libitum with layers' complete fodder (Reudink Biologische Voeders B.V, Boxmeer, The Netherlands) in the pen.

2.2. Experimental design

The study was conducted on an experimental site of the Department of Crop Sciences of Göttingen University, Göttingen, Lower Saxony, Germany (51°32'51" North, 9°56'47" East). Fourteen species of grassland plants were used to establish the 15 sward types for the experiment. The main criterion for their choice was their known high tolerance to intensive management, i.e. to frequent grazing, cutting and trampling (Dierschke and Briemle, 2002). We expected that these traits would confer a high persistence of the sward under conditions of stocking with chickens. In most of the grass species, turfgrass cultivars featuring a high wear tolerance (e.g. for sports turfs) were chosen (Bundessortenamt, 2006). The following plant species were used: grasses: *Agrostis stolonifera* L. 'Barifera', *Deschampsia cespitosa* L. (wild-type), *Elymus repens* L. (wild-type), *Festuca arundinacea* Schreb. 'Mustang', *F. rubra rubra* L. 'Rossinante', *F. trichophylla* Ducros ex Gaudin 'Barcrown', *Lolium perenne* L. 'Bargold', *Poa pratensis* L. 'Julius', *P. supina* Schrad. 'Supreme'; forbs: *Achillea millefolium* L. (wild-type), *Plantago major* L. (wild-type), *Ranunculus*

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