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DISTRIBUTION OF LAYING HENS DURING THE GRAZING PERIOD IN OUTDOOR PADDOCKS WITH DIFFERENT RETENTION MATERIALS

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Abstract: This study compared the P retention materials sand and limestone with gravel in a randomized block design with three replicates to evaluate the effect on hens' distribution in the paddock between 1 May and 31 October. Each flock included 76 animals having access to a paddock (3.4 x 19.9 m), where material (3.4 x 3.0 x 0.2 m) was placed outside the pop-hole. The average amounts of hens' outdoors were documented at 9 am and 3 pm each day. There was no significant difference between the materials concerning hens' distribution and they seemed to be equally comfortable. Instead weather conditions influenced hen distribution. The sub-area with material close to the house was more frequently used by hens during the hot and dry summer. The hen's choice was promoted by a roof above the pop-hole giving shade. With lower temperatures and rain showers later the hens' distribution pattern changed significantly ($P<0.001$) and they were more evenly distributed over the paddock area during autumn.

Introduction: Organic egg producers face challenges to combine animal welfare and environmental issues when giving the hens access to outdoor paddocks. There is a lack of knowledge for making accurate environmental risk assessments of phosphorus (P) leaching from paddocks, and for suggesting appropriate measures for organic egg production. This study investigated two types of P-retention materials (sand and limestone) outside houses for laying hens, as a measure to retain P. The materials were also selected to fulfil the criteria's for being comfortable for the hens, not unhealthy to eat, have a reasonable investment cost, promote animal health and egg production. The hens' distribution pattern in the paddock was hypothesized to reflect distribution of excretions (Menzi et al., 1997) and animals' preferences for the material. This paper focuses on the hen distribution while results on environmental performance are presented in a companion paper by Aronsson et al. in these proceedings.

Material and methods: The field experiment was conducted at the Swedish livestock research center east of Uppsala from 1 May to 31 October 2018. The spring and summer weather were extremely dry and hot, compared to normal for the site and period (SMHI, 2018). Three different materials (3.4m x 3.0m) were placed randomly outside the entrance of the laying hen house with a thickness of 0.2 m in three replicate blocks, giving a total of 9 outdoor paddocks (each paddock

3.4m x 19.9m corresponding to 1.1 m^2 per animal). From the material and beyond, the ground in the paddock was covered with grass and herbs in April but in May only few living plants were left and thereafter no living plants were visible until a few after the rains. The natural sand and the limestone approved as feed additive (ø 0 – 4 mm for both) were chosen as they have a P retention ability and were allowed to use in organic production. Natural gravel (ø 8-12 mm) was included as control material.

The hens of the breed Bovans Robust (*Gallus gallus domesticus*) were reared according to organic standards and brought to the layer house at an age of 16 weeks. Before the experiment the animals were habituated during four weeks to the paddock. At the end of the experiment the hens were 46 weeks old. During the experimental period each group included 75 laying hens and one rooster having access to one paddock 24 hours a day. The hens were fed indoors with organic feed where they also had access to water, nest and perch. The house was illuminated by artificial light in times of insufficient daylight. The distribution of hens in the paddock was documented at 9 am and 3 pm each day. The documentation was conducted for three sub-areas in the paddock: close to hen house (0- 3.3m), middle of the paddock (3.3- 6.8m), furthest away from hen house (6.8-19.9m). The used scoring of number of hens was: No hens, 1 – 10 hens, 11 – 25 hens, 26 – 50 hens and 51 – 75 hens. Once a month ten randomly selected hens per group were individually scored for signs of feather pecking and injures on feet according to guidelines used by advisors on commercial farms to assess animal health. The egg production, food consumption and flock health were recorded continuously.

For the statistical analysis of hen distribution, the used model was a general linear mixed model with treatment (sand, limestone, gravel), week and sub-area as fixed factors and block as a random factor. All interactions between the three fixed factors were included, but insignificant interactions were removed one at a time. As the observations were made over time during 26 subsequent weeks, we included a time series structure on the error term (repeated measures model). For this the time series observed on each of the sub-areas of each paddock were modeled to follow the same autoregressive structure with lag 1 (AR(1)). The model was fitted using the procedure MIXED in SAS software, version 9.4, © 2002-2012 SAS Institute Inc.

Results: A total of 364 observations were made, giving an average percentage of hens outside of 43% in May and June, while about 26% were outside in October. This was a higher proportion than Hegelund et al. (2005) found at five commercial farms where they recorded 0-25% of the hens outdoors with a variation between flocks.

There was no significant difference in average number of hens at 9 am and at 3 pm between paddocks with sand, limestone and gravel materials ($P<0.05$). This indicated that hens did not prefer or avoid a certain material compared to the others. Instead there was on average significant more hens on the sub-area close to house compared to sub-areas in the middle and furthest away from house from 3rd of May to 3rd of September ($P<0.001$), Figure 1. The hens' preferences were probably reinforced by a small roof 1.5 m long over each pop-hole giving shadow and shelter (Hegelund et al., 2015). Thereafter the differences in average number of hens between sub-areas were smaller with few significant differences, indicating that hens were more evenly distributed over the paddock area. The hens' preference for different sub-areas changed over the experimental period where a change in distribution behavior occurred after a weather change. The weather was hot and dry the first half of the outdoor period and cooler with rain showers the latter half, Figure 2. During rain at observation time we noticed that the hens was not outdoors, which was in accordance with Hegelund et al. (2015). After the autumnal equinox, the daylight hours decreased markedly in late September and October.

The animal health status considered to be good in all flocks. There were some feather pecking at the end of the experiment and some bumble injuries at the feet. However, there were no differences in occurrence between materials.

The egg production was comparable with the manual for potential production characteristics in free-range egg production indoors Bovans Robus, Table 1.

Figure 1. Average number of hens per week in sub-areas within the paddock; close to hen house, middle and furthest away from hen house.

Figure 2. Total precipitation, average temperature and average insolation per week during the experimental period.

Table 1. Production characteristics

Characteristics	Manual	Treatments		
		Gravel	Sand	Limestone
Summary eggs hen^{-1} week 16-45	166	193	189	189
Layed eggs at week 45, %	92	91	89	89
Average egg weight at week 45, g	64	63	63	63
Consumed feed hen^{-1} & day^{-1} at week 45, g	111	118	118	121

Discussion: The hens preferred the sub-area close to the hen house during May - August when the weather was hot, dry and sunny. The hens did not avoid any of the three different materials and we regularly noticed hens dustbathing especially in the sand and limestone materials. The hens' frequent use of this sub-area also meant a frequent excretion on the materials (Menzi et al. (1997). In the end of July the weather changed with regular rain showers and lower temperatures. Beginning of September, the hens changed their distribution behavior irrespective of material and spread more even over the paddock length. The rainy period made the soil soft and easy to manipulate, which probably attracted the hens to explore the whole paddock area. Conclusions are that there was no difference between the tested materials concerning hens' preference for staying on it. Instead, a change in weather influenced the hens' distribution and excretion pattern in outdoor paddocks.

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Image:

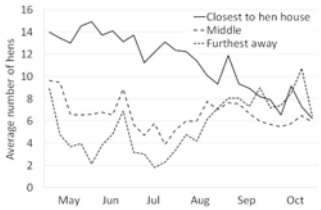
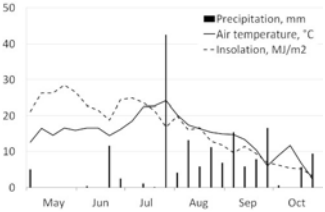


Image 2:



Disclosure of Interest: None Declared

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