

THE LAYING OF FLOOR EGGS BY BREEDER HENS AS
INFLUENCED BY NESTING BEHAVIOUR AND SHED DESIGN

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SUMMARY

The laying of eggs on the shed floor rather than in provided nests can represent a considerable loss to the producer of fertile eggs from, breeding flocks. In an attempt to understand why some hens choose to lay on the floor, a study of the nesting behaviour of the hen was undertaken. Behavioural studies conducted on flocks of commercial broiler hens, bantams and White Leghorns revealed that hens carry out a particular behaviour sequence both before and after the laying of an egg.

Nest preference trials conducted so far have indicated the preference of both bantam and Leghorn hens for litter lined, as opposed to bare metal nests, for nests containing other eggs or dummy eggs and for nests which possess an added dimension of confinement. Studies of floor laying in 45-hen litter pens under conditions similar to those found in commercial situations have also indicated the beneficial influence of a more easily accessible approach to the nest-set and of providing an additional dimension of confinement to the nests on nest usage.

INTRODUCTION

A major concern of the commercial producer of fertile eggs from broiler breeder hens is that eggs are laid in sites with a low level of microbiological contamination and in positions from which they can be easily collected. Traditionally, these requirements have been met by the provision of elevated nest-sets within the shed. Unfortunately, a proportion of hens lay on the shed floor rather than in such nests. Soilage of floor eggs tends to result in decreased hatchability of eggs and a higher incidence of omphalitis and salmonellae shedders among chicks hatched from them. In addition, the presence of floor eggs leads to inefficient egg collection and, hence increased labour costs involved in the collection and also in the-cleaning of eggs. Two vices probably associated with floor laying include enhanced egg breakage and egg eating and the increased incidence of vent pecking and associated damage to the oviduct.

To date few attempts have been made to determine what factors influence the proportion of eggs laid on the shed floor. However,

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Bressler (1961) was able to reduce floor laying by placing nests in areas of the shed where floor eggs were a problem, while Hurnik *et al.* (1973a) found that the provision of multi-coloured nest-sets as opposed to plain galvanised sets resulted in the laying of fewer floor eggs. While some reports (Daly *et al.* 1964) have shown that the type of nesting material used influences the percentages of floor eggs laid, others (Baker 1962) could detect no significant relationship between the type of nesting material and the incidence of floor laying. Dorminey *et al.* (1970) found a variable incidence of floor eggs in pens with artificial lighting of different intensities, but could not detect any significant relationship between floor egg incidence and light intensity. However, in a later study Dorminey (1974) demonstrated a higher proportion of floor eggs from pullets housed in fan ventilated sheds with artificial incandescent light only than from others housed in sheds with natural ventilation and natural plus artificial light.

A number of factors have been shown to influence nest selection and include the type of nesting material used (Hansen *et al.* 1948; Siegel and Howes 1959; Daly *et al.* 1964), the colour of the nest (Humik *et al.* 1973b), the height of the nest above the floor (Wood-Gush and Murphy 1970; Woods and Laurent 1958) and the degree of darkness in the nest (Wood-Gush and Murphy 1970).

Of particular interest is McGibbon's (1976) finding that genetic differences exist between floor laying and non-floor laying hens both within and between breeds and strains in certain environments.

In order to understand why different hens select different nest sites, an appreciation of how hens go about the selection of sites may be beneficial. While such studies are documented for the feral domestic fowl (McBride *et al.* 1969; Duncan *et al.* 1978), battery-caged hens (Wood-Gush and Gilbert, 1969a), trap-nested small flocks (Wood-Gush 1963; Wood-Gush and Gilbert 1969b) and solitary, penned hens (Wood-Gush 1975), similar studies of hens under commercial pen conditions are lacking. The behavioural trial reported in this paper sought a description of nesting behaviour in several breeds but particularly the previously neglected heavier broiler breeds, in penned situations in which competition for nests may be operative. Nest preference trials were also conducted to determine some of the factors influencing the selection of nest site. In a third set of trials, the influence of several factors on the extent of floor laying in broiler breeder flocks was investigated.

MATERIALS AND METHODS

Birds and housing

Birds used in nesting behaviour and nest-preference trials were housed within a three-pen isolation shed. Each deep litter pen measured 4.78 m x 3.71 m and was provided with a double tiered, 14 hole nest-set elevated 0.69 m above the floor. In one such pen was housed a flock of 37 restricted-fed, point of lay pullets of a commercial broiler strain, in another a flock of 25 laying White Leghorn hens plus three cockerels and in the third a flock of 18 Wheaten Old English Game bantam pullets plus three cockerels.

The broiler breeders used in floor laying trials were housed in the experimental broiler breeder shed at the Laureldale Rural Research

Station, Armidale. Forty five restricted-fed, point of lay pullets and six cockerels of a commercial broiler breeder strain were housed in each of 48, 3.6 m x 2.5 m pens within the shed. Each pen was provided with a double-tiered, six nest/tier open backed nest-set, elevated 15 cm above the floor and accessible to the birds on upper and lower levels by a single metal perch approach at a distance of 15 cm and 25 cm respectively from the front of the nest-set.

Behavioural trials

Observations of the pre- and post-laying behavioural patterns exhibited by the broiler hens were recorded for up to two months into lay. Daily records were kept of what particular behavioural patterns associated with oviposition were performed by each hen, when they performed these activities and where they eventually laid. Similar observations were also made for the bantam and Leghorn hens.

Nest preference trials

Records were kept over a 19 day period of the daily distribution of eggs between the 14 nests in the Leghorn pen. Daily and overall records were analysed by Chi-Square analysis for any positional preferences within the set and for any tendency for eggs to be laid in nests already containing eggs.

In a further 40 day trial, preferences were compared for nests which did or did not contain nest litter (soft wood shavings) within the sheet metal nest and which did or did not possess an extra dimension of confinement, achieved by the use of hessian curtains over the nest entrance. A similar 22 day trial was conducted to determine preferences for nests combining the presence or absence of nest litter and the presence or absence of an egg in the nest. In these trials the pen of 18 bantam hens was compared with the pen of Leghorn hens (reduced from 25 to 18 hens). For both trials, the four possible nest combinations were replicated on top and bottom nest levels, and the position of each possible combination was reallocated randomly in the nest level each night. The criterion used to determine preference was the nest in which the hen eventually laid. Eggs were collected twice daily. Results were analysed daily and overall by Split-Plot Analysis of Variance..

Floor laying trials

Four floor laying trials were conducted simultaneously. In each trial a row of 12 pens was studied, and each of the four treatments was replicated in three pens. The treatments consisted of:

Trial I: a two x two factorial design comparing pens with or without a hessian curtain hung over the entire nest-set, extending out 50 cm from the bottom metal perch and within 12 cm from the pen floor, and either having the area under the nest-set blocked off or not.

Trial II: a four treatment design involving a comparison of the existing nest-set with nest-sets possessing approaches which had been altered to enable easier access of nests to hens.

Trial III: a four treatment design comparing nest-sets with either the upper or lower tier of nests closed off and either the

existing or an altered approach provided.

Trial IV.: a two x two factorial design comparing pens with or without nest-eggs provided in all nests and with or without an extra dimension of confinement provided by the addition of sheet metal backings to the open backed nests.

All alterations to existing nest design were completed the day preceding the first day of recording. Nest and floor eggs were collected three times daily and weekly floor egg percentages and proportions of nest eggs laid in lower nest levels were calculated and submitted to an Analysis of Variance. Records were kept for the first 12 weeks of lay and for another week two months later.. After the eighth week of lay, the area underneath the nest sets, which had previously been a popular site for floor laying, was covered in with litter in all pens except those involved in Trial I.

RESULTS

Nesting behaviour trials

Within the described environment, nesting behavioural patterns observed tended to follow a particular sequence. This has been described in detail by Kite et al. (1979). Although most hens followed the same general nesting sequence, there existed considerable individual variability in the extent to which any particular activity was carried out and the type of nest selected.

Several phases in the nesting behavioural sequence could be distinguished. The first phase was characterised by a general restlessness, associated with the pacing of pen walls and a particular vocalisation, the nesting call. Following this phase, a period of nest examination and entry ensued leading into a phase of nest sitting, nest-building and., eventually, oviposition. After laying, hens would either sit within the nest or immediately leave the nest. Leaving the nest was sometimes associated with a post-lay, cackle.

It was found that after laying only a very few eggs most hens, whether floor or nest layers, developed strong positional preferences for nest sites. Not all sites within the pen were equally often chosen as nest sites by hens ($P < 0.001$). Generally, the more confined the site the more popular it was.

Nest preference trials

In the initial nest preference trial, the tendency for the White Leghorn hens to lay in nests already containing other eggs was established ($P < 0.001$).

Data generated from the nest litter/nest curtaining trial: demonstrated that the presence of litter within the nest was critical to selection of a nesting site (Table 1), while the presence of curtains was of lesser importance, although the popularity of curtained nests increased significantly ($P < 0.001$) over time for both breeds.

The nest litter/nest egg preference trial again indicated that the presence of litter in the nest was critical to selection of nest-site while the presence of an egg in the nest was preferred by both breeds,

but was of secondary importance (Table 2).

T A B L E 1

Numbers of eggs laid by bantam and Leghorn hens in either litter lined or bare sheet metal nests in a 40 day trial

Type of nest	Breed		Total both breeds
	Bantams	Leghorns	
Litter lined	174	583	757
Bare metal	7	0	7
Significance			P < 0.001

TABLE 2

Numbers of eggs laid by bantam and Leghorn hens in nests which either contained or did not contain nest litter and nest eggs in a 22 day trial

Type of nest	Nest egg			No nest egg			Total (egg or no egg)
	Bantams	Leghorns	Both breeds	Bantams	Leghorns	Both breeds	
Litter lined	85	220	305	23	72	95	400
Bare metal	11	0	11	0	0	0	11
Total (lined or bare)			316			95	411

Floor laying trials

Results of floor laying trials revealed that curtaining of the nest-set as carried out did not influence floor laying significantly. Altering the nest approach so that the nest-set became more accessible to nesting hens, however, proved to be highly successful in reducing floor laying (Fig. 1). Eliminating upper, or particular, lower nest levels resulted in extremely high floor egg percentages, and the other level of nests had to be opened up to prevent excessive floor laying, after three weeks (Fig. 2).

The presence of the metal nest backs resulted in significantly reduced floor egg percentages ($P < 0.01$ for the first eight weeks) while the presence of nest-eggs had little effect on floor laying (Fig. 3).

DISCUSSION

Observations on the use of elevated nests by hens indicated that possibly the major cause of the lack of acceptance of such nests to the heavy, awkward meat-type birds as opposed to lighter more agile breeds, is the accessibility of the nests. The importance of accessibility was

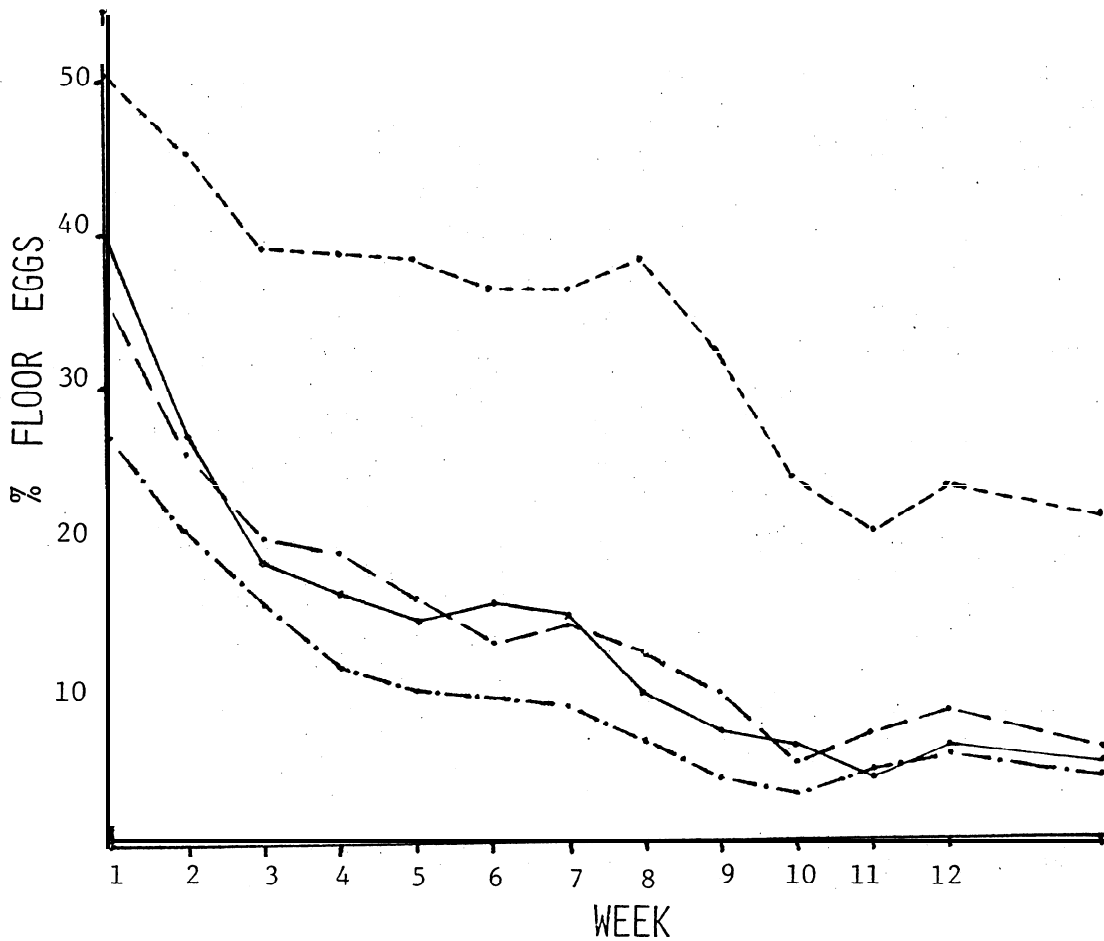


Fig. 1 The mean floor egg % (% of total eggs which are laid on the floor) in pens with existing nest set approach (-----), approach of one wooden rung on the upper level and three on the lower level (— — —), a four level step-up approach of wooden rungs (·—·—·) and the same step-up approach but with approach divided into three (·····) over time.

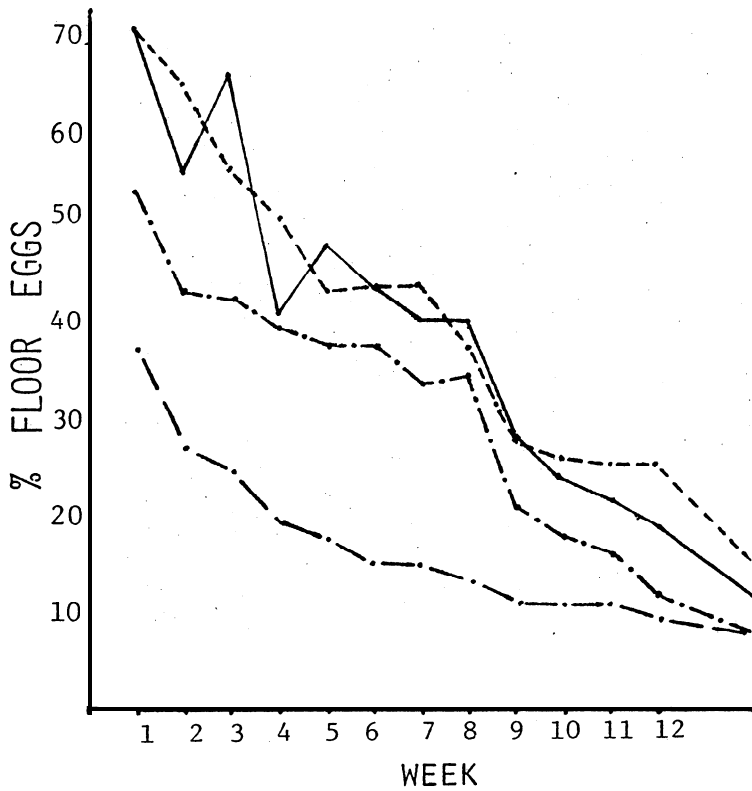


Fig. 2 The mean floor egg % in pens with top level nests only and the existing approach (---), top level nests only and a wooden step-up approach (—), bottom level nests only and the existing approach (-·-) and bottom level nests only with a three wooden rung platform approach(- - -) over time. Beyond three weeks all pens have the existing nest-set and approach.

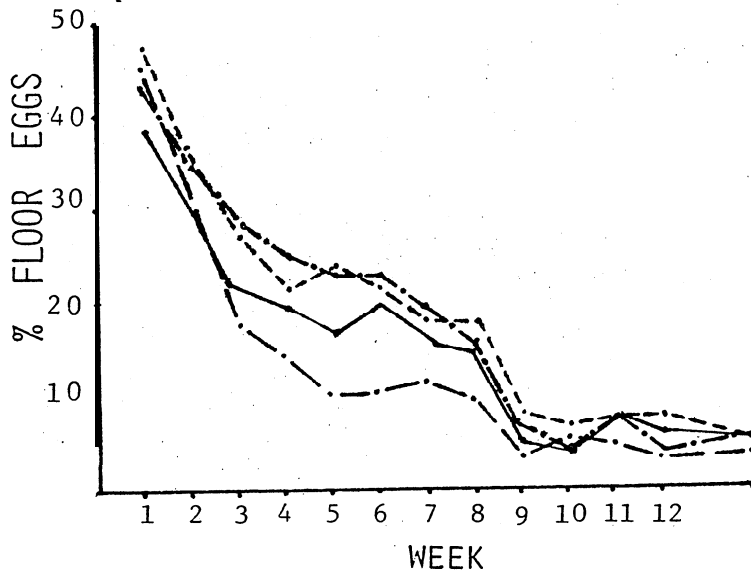


Fig 3 The mean floor egg % in pens with nests without metal backs and not containing nest-eggs (-·-), with metal back and not containing nest-eggs (—), without metal backs and containing nest-eggs (---) and with metal backs and containing nest-eggs(- - -) over time

substantiated by the results of floor laying trials comparing existing and adjusted nest-set approaches. The affect of height on accessibility of the nest-set is indicated by the very poor acceptance by broiler breeder hens of nest-sets in which only the upper tier- was available.

Regardless of how preferable one type of nest may be over another when hens are allowed to chose between them, the provision of the more favourable type of nest in the shed may not necessarily improve the nest laying situation. This is so because a hen appears to use a number of criteria in the selection of a nest site. In order to minimize floor laying it is necessary to ensure that the combination of criteria, or stimuli, which occurs within the nest is more favourable to the nest-seeking hen than any other combination of stimuli which occurs on the shed floor. As an illustration, although mature laying hens in preference trials chose to lay in nests containing other eggs or dummy eggs, the use of nest-eggs did not have a significant influence on the use of provided nests, possibly because of a lack of recognition of the egg by pullets in early stages of lay when floor laying tendencies are established. To complicate matters, there would appear to exist considerable individual variability between hens in what criteria are used in the selection of a nest, and in their preferences for particular factors associated with the acceptability of the nest.

While many criteria may be involved in the selection of nest site by hens, different weightings may be given to different criteria and so some may have a greater influence on site selection than others. Results obtained so far have indicated the importance of nesting material to nest selection and the lesser importance of nest-eggs and the provision of greater isolation of the nest. The influence of these criteria on floor laying cannot be assumed, as was found in the case of nest-egg preferences and floor laying. However, as the influence of other factors on nest selection are determined, the possibility of designing nests which are both acceptable and accessible to nesting hens will be enhanced.

ACKNOWLEDGEMENT

This study was supported by funds provided by the Australian Chicken Meat Research Committee to whom the authors are grateful.

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