EFFECTS OF STOCKING RATE ON THE PERFORMANCE OF TWO HYBRIDS OF COMMERCIAL BROILERS IN THE HUMID TROPICS

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ABSTRACT

The effects of four stocking rates (0.070, 0.093, 0.116 and 0.140m²/bird) on the performance of two hybrids of commercial broilers were investigated. There were significant hybrid effects on initial and final body weights ($P < 0.01$) and on feed efficiency ($P < 0.05$) but not on average daily gain, feed consumption and mortality.

Stocking effects which were not significant for initial body weight, feed efficiency and mortality were highly significant for final body weight, average daily gain and feed consumption ($P < 0.01$).

There were significant interactions between hybrid and stocking rate for average daily gain ($P < 0.01$) and mortality ($P < 0.05$).

It is suggested that in the humid tropics, the stocking rates of 0.116 and 0.140m²/bird would be appropriate for rearing broilers. The results of the study also showed that different hybrids do vary on space requirements in respect of certain production traits.

INTRODUCTION

The strain or breed of birds has been implicated as one factor which combines with stocking rate in affecting the performance of broiler chickens (Moreng *et al.*, 1961 and Andrew and Goodwin, 1969).

There is considerable discrepancy in the literature concerning the effect of stocking rate on the performance of broiler chickens. While Brooks *et al.*, (1957); Olinde *et al.*, (1965); Hansen and Becker (1960); Hartung (1955); Balaji *et al.*, (1976); Derlug-

yan *et al.*, (1975) and Veitsman *et al.*, (1976) reported a progressive decrease in growth and/or feed conversion efficiency as a result of increasing population density. Others including Rao *et al.*, (1977) and Castro *et al.*, (1978) indicated that stocking rate had no significant effect on growth rate, efficiency of feed conversion and mortality of birds.

Almost all of these studies have been conducted in the temperate climate, the recommendations of which may not necessarily apply to the tropical environments. Unlike the temperate areas where the birds need be close to one another to exchange body heat for adequate warmth, birds in the tropical climate may need to have more space to dissipate the excess body heat. Owing to differences in climatic conditions, the adoption of temperate stocking rate recommendations in the tropical environment may make the birds liable to heat stress which is known to adversely affect feed consumption, feed efficiency, growth rate and mortality. The rate of disease spread, cannibalism and number of birds culled may also be on the increase when birds are densely packed.

It is therefore the need to adjust these recommendations to suit the tropical conditions that prompted the present study which aimed at investigating the effects of stocking rate,

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hybrid and their interaction on some production traits in commercial broilers in a tropical environment typified by South Western Nigeria.

MATERIALS AND METHODS

Experimental Procedure:

Two hundred and ninety-nine 5-week-old birds each of two commercial hybrid broiler types designated hybrid A and hybrid B respectively were used in the investigation.

The birds were raised on conventional starter ration used at the Obafemi Awolowo University from day old till 5 weeks of age when they were fed a broiler finishing ration (table 1).

At 5 weeks of age, the birds were wingbanded, individually weighed and randomly distributed among the four stocking rate treatments viz: 0.070,

0.093, 0.116 and 0.140m² per bird. The birds of each hybrid were divided into 12 groups and the groups were randomly allocated in pens made by partitioning the broiler house using wooden planks and wire-netting in such a way as to permit straight-through ventilation. There were three replicates for each hybrid x treatment cell. The number of birds per replicate ranged from 13 to 38 depending on the size of the pen and the stocking rate in question.

The birds had about 13 hr. natural light per day and feed and water were supplied *ad libitum*. The feeders and waterers were allotted proportionately, depending on the number of birds in the pens.

Feed consumption per bird was calculated from the records of feed intake of birds in each group and feed

TABLE 1.

Composition of broiler finishing diet fed to all treatment groups

Ingredients (g/kg)

Yellow maize	629.0
Groundnut meal	155.5
Fish meal	35.0
Dried brewers grains	155.0
*Vitamin-mineral mix	5.0
Dicalcium phosphate	10.0
Oyster shell	10.0
Amprolium	0.5

Calculated nutrient composition (per kg)

Protein (g)	186.2
Metabolisable Energy (Kcal)	3017.75
Calcium (g)	7.90
Phosphorus (g)	5.20
Lysine (g)	7.20
Methionine (g)	3.30

*Supplying per kg diet: Vit. A 25,000 I.U., Vit D₃ 2,500 I.U., Vit. E 5 I.U., Vit. K. 5mg, Riboflavin 12.5mg, Pantothenic acid 27.5mg, Nicotinic acid 62.5 mg, Choline Chloride 750mg, Vit. B12 0.025mg, Antioxidant 312.5mg, Procaine penicilline and Zinc batracin 25mg, Mg. 200mg, Zn. 125mg, Io 3mg, Co. 0.5mg, Cu 5mg and Fe 62.5mg.

efficiency was determined on group basis using average body weight from two weeks, and expressed as gram body weight gain per gram feed consumed.

The birds were weighed individually every 14 days until they were 13 weeks old and average daily weight gain calculated on group basis fortnightly. Record of mortality was also kept during the experimental period.

Statistical Methods.

A total of 598 observations were made on body weight and average daily gains. Twenty four measurements were made on feed consumption, feed efficiency and mortality. Group means were used for feed consumption, feed efficiency and mortality. For the other traits, individual observations were used. All data were analysed by analysis of variance using two models. Each model included fixed effects of hybrid, stocking rate and hybrid x stocking rate interaction.

The model for feed consumption, feed efficiency and mortality was similar to that of body weight and average daily gain except for the exclusion of groups. Statistical significance of mean differences were determined by Duncan's New Multiple Range Test (Steel and Torrie, 1960)

RESULTS

The results are shown in table 2. There were significant hybrid effects initial and final body weight ($P < 0.01$) and on feed efficiency ($P < 0.05$) but not on average daily gain, feed consumption and mortality. Stocking rate effects which were non-significant for initial body weight, feed efficiency and mortality were highly significant for final body weight, average daily gain and feed consumption ($P < 0.01$). In addition, there were

significant hybrid x stocking rate interaction effects on average daily gain ($P < 0.01$) and mortality ($P < 0.05$) whilst group effects were highly significant for initial body weight ($P < 0.01$).

The initial advantage of hybrid B over A in body weight was also reflected in the final body weight. Of the two hybrids, hybrid A consumed less feed and gained a slightly more weight per day and so had a significantly better feed efficiency than hybrid B.

For final body weight, birds allowed 0.140 and 0.116m² of floor space each, were heavier than their counterparts raised at stocking rates of 0.093 and 0.070m² per bird.

Birds allowed 0.070 and 0.093m² of floor space each consumed less feed than birds on the lower stocking rates. The differences in feed consumption with respect to the four stocking densities were not accompanied by corresponding differences in feed efficiency. Birds allowed floor spaces of 0.140 and 0.116m²/bird which also consumed more feed per day significantly gained more weight per day than birds raised at stocking densities of 0.070 and 0.093m²/bird.

Birds housed at lower stocking rates (0.140 and 0.116m²/bird) on the average, had the same initial body weight (0.67) and feed efficiency (0.23g. weight gain/g. feed consumed) as those housed at higher stocking rates. Although birds housed at higher stocking rates had a lower mortality than those housed at lower stocking rates, the difference was not significant ($P < 0.05$).

The pattern of hybrid x stocking rate interaction effect on average daily gain (table 2) indicated that hybrid A performed better in terms of average daily gain when housed at the rate of 0.116m² of floor space per bird, whereas hybrid B had its best

TABLE 2.

Initial and final body weights, average daily gain, feed consumption, feed efficiency and mortality of two broiler hybrids raised at four stocking rates.

Hybrid	Stocking rate ($m^2/bird$)	Body Weight Initial (5 wks)	Final (13 wks)	Average daily gain (g/day)	Feed consumption (g/bird/day)	Feed efficiency (g. wt. gain/g. feed consumed)	Mortality (%)
A	0.070	0.59 ^a	2.01 ^a	22.6 ^a	97.0 ^a	0.26 ^b	21.3 ^{ab}
	0.093	0.61 ^a	2.05 ^a	22.6 ^a	103.9 ^{ab}	0.23 ^{ab}	24.2 ^{ab}
	0.116	0.60 ^a	2.20 ^{ab}	27.0 ^{bc}	118.5 ^{bc}	0.24 ^{ab}	12.6 ^a
	0.140	0.59 ^a	2.10 ^{ab}	24.3 ^{ab}	126.7 ^{bc}	0.22 ^a	28.8 ^b
	SE	0.69 ^a	2.01 ^a	21.2 ^a	108.3 ^{ab}	0.23 ^{ab}	14.5 ^a
B	0.070	0.77 ^a	2.19 ^{ab}	22.6 ^a	112.5 ^{ab}	0.21 ^a	23.2 ^{ab}
	0.093	0.77 ^a	2.30 ^{ab}	24.8 ^{ab}	141.3 ^c	0.21 ^a	28.1 ^b
	0.116	0.82 ^a	2.50 ^b	28.9 ^c	128.1 ^b	0.22 ^a	16.6 ^{ab}
	0.140	0.41	0.10	1.185 ^{**}	7.77	0.01	3.84 [*]
	SE						
Hybrid means							
A		0.60 ^a	2.08 ^a	24.0 ^a	111.5 ^a	0.24 ^b	21.7 ^a
		0.75 ^b	2.20 ^b	23.7 ^a	122.6 ^a	0.22 ^a	20.6 ^a
B		0.31 [*]	0.027 ^{**}	0.324	3.89	0.005 [*]	1.92
	SE						
Stocking rate means							
0.070		0.64 ^a	2.01 ^a	21.9 ^a	102.7 ^a	0.24 ^a	17.9 ^a
		0.69 ^a	2.12 ^a	22.6 ^a	108.2 ^a	0.22 ^a	23.7 ^a
0.093		0.69 ^a	2.56 ^b	26.4 ^b	129.9 ^b	0.23 ^a	20.4 ^a
		0.64 ^a	2.36 ^b	26.6 ^b	127.4 ^b	0.23 ^a	22.6 ^a
0.116		0.045	0.040 ^{**}	0.477 ^{**}	5.50 ^{**}	0.007	2.72
	SE						

Values are means with appropriate SE of differences of three replicates per stocking rate treatment for each hybrid, those bearing different superscripts differ significantly * $P > 0.05$, ** $P < 0.01$

performance at the lowest stocking rate of 0.140m^2 per bird. The result also showed that the performance of both hybrid broilers with respect to average daily gain was similar at the stocking rate of 0.093m^2 /bird.

Table 2 also shows the trend of hybrid x stocking rate interaction effect on mortality. The stocking rate which was a bit favourable to hybrid B appeared most unfavourable to hybrid A in terms of mortality.

DISCUSSION

The names of the hybrids used in this study were not disclosed since the objective was to investigate whether or not they differ in stocking rate requirements and production traits rather than to evaluate their relative merits. Moreover, the project was not commissioned nor its publication authorised by the poultry breeders.

The depression in feed consumption, rate of gain and final body weight at higher stocking rates in the present study is in agreement with the findings of Brooks *et al.* (1957), Hansen and Becker (1960), Moreng *et al.* (1961), Bolton *et al.* (1972) and Derlugyan *et al.* (1975). Retardation of growth with increasing population density has been attributed to restricted access to feed and water on one hand and to the direct physiological effect of the high stocking density on chickens on the other hand (Hansen and Becker, 1960).

In the present study, it was observed that the birds housed at the higher stocking rates of 0.070 and 0.093m^2 /bird panted continuously and at a higher rate than those housed at the lower stocking rates, especially during the hot period of the day. This indicated stress conditions which may have been responsible for the adverse effects noted at the higher stocking

rates more than the inadequate feeder and water space adduced by Hansen and Becker (1960). Similar observations to that of the present study were made by Bolton *et al.* (1972).

The lack of significant effect of stocking rate on feed efficiency observed in this study conforms with the results of Cavaleiro *et al.* (1977), Rao *et al.* (1977), Chew (1977) and Castro *et al.* (1978).

Contrary to the findings of this study in which the depression in feed consumption was unaccompanied by improved efficiency of conversion, Brooks *et al.* (1957), Moreng *et al.* (1961), Olinde *et al.* (1965) and Bolton *et al.* (1972) reported that better feed conversion ratios were obtained from birds having the higher stocking density. These authors explained that heavily stocked birds insulated one another from heat loss, which along with the restriction in the movement of birds reduced caloric demand and appetite thus causing lowered food intake and higher efficiency of utilization.

Lower efficiency of utilization at higher stocking rate has also been reported (Andrew and Goodwin, 1961 and Derlugyan *et al.* 1975). This probably resulted from the fact that the studies were conducted during the hot summer months and using higher stocking rates than were used in the present study. While the range of stocking rate used in the present study was 0.070 to 0.140m^2 /bird, Derlugyan *et al.* (1975) employed a range of 0.055 to 0.079 , and Andrew and Goodwin (1969) used a range of 0.037 to 0.074m^2 /bird. These reports could be in agreement with the findings of Moreng *et al.* (1961) who observed that birds allowed 0.093m^2 of floor space grew well during the fall, winter and spring months, but that during the summer months, floor space should be increased to

0.116m² to attain comparable growth rate.

In the present investigation, stocking rate independently had no effects on mortality of broiler chickens. Similar observations were made by Balaji *et al.* (1976), Chew (1977) and Gonzalez *et al.* (1978).

The significant hybrid effects on body weight and feed efficiency observed in this study seems to confirm that the strain or breed of birds is a factor which may combine with stocking rate in affecting body growth and feed efficiency. A similar view has been expressed by Moreng *et al.* (1961) and Andrew and Goodwin (1969).

In this study, the significant stocking rate x hybrid interaction effects observed on average daily gain and mortality suggest that these two factors do not affect the two traits independently, and that different hybrids do vary on space requirements.

From the results of this study, it could be concluded that on account of feed consumption, rate of gain and final body weight, lower stocking rates of 0.116 and 0.140m²/bird are desirable for raising broilers under the tropical conditions. Where both stocking rate and hybrid are to be considered simultaneously, the results of this study also suggest that hybrid A is better reared at a stocking rate of 0.116m²/bird while a corresponding stocking rate for hybrid B is 0.140m²/bird.

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