

## THE EFFECT OF STOCKING DENSITY AND FEEDER TYPES ON THE PERFORMANCE OF GROWING RABBITS UNDER CONDITIONS PREVAILING IN CAMEROON.

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**ABSTRACT:** Weaned rabbits fed with a maize based diet supplemented with Guatemala grass were used in a factorial experiment to compare the effects of stocking rate (5 vs 10 per m<sup>2</sup>) and feeder type on production parameters and mortality over an 8 week period under Cameroon conditions. Stocking rate did not affect ( $P>0.05$ ) feed intake, feed conversion efficiency or mortality rates. Increasing the number of animals from 2 to 4 in a cage resulted in a significant decrease in daily weight gain ( $P<0.05$ ) and final body weight ( $P<0.01$ ) and a significant ( $P<0.01$ ) increase in the amount of feed wasted. The type of feeder had no significant ( $P>0.05$ ) effect on feed intake, growth rate, feed conversion efficiency or mortality rate. However, feed wastage was significantly ( $P<0.01$ ) affected by feeder type and was greatest with the metallic J-feeder. The sex of the animal did not affect ( $P>0.05$ ) any of the parameters measured. The interaction between sex, feeder type, and cage density had a significant ( $P<0.01$ ) effect only on feed wastage. The results of the study showed that rearing rabbits in pairs per cage and using a cylindrical metallic tin feeder would enhance faster growth and reduce the amount of feed wasted.

**Key words:** stocking density, feeder type, feed intake, growth, weaning rabbits.

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## INTRODUCTION

Studies on intensive management systems have shown that weaned rabbits could be conveniently reared under a stocking rate of ten fryer rabbits per square meter or ten or more fryers in larger pens, to minimize labour (LUKEFAHR *et al.*, 1980). For

maximum productive performance, feed should be offered in feeders that are accessible to rabbits, easily cleaned and spill proof (McNITT, 1980; SEP, 1982; LUKEFAHR, 1992). Automatic feeders have proved to be most suitable (CHEEKE *et al.*, 1987) but this is not affordable to small-scale producers in rural areas. There is a need to evaluate other available feeders that could serve the same purpose i.e. reduced spillage, easy accessibility and enhanced feed intake, and also a need to determine the appropriate stocking rate for optimum performance. This study was undertaken to determine the effects of three types of feeders and two stocking densities on feed intake, feed wastage and growth performance of weaning rabbits.

## MATERIALS AND METHODS

### Animals and management

The experiment was carried out at the Agricultural Research Station for Development in Mankon from May to July 2000. Seventy-two crossbred rabbits (New Zealand White x Mankon Black) were used in the study. There were 36 males and 36 females aged 8 weeks and with mean initial live-weight of  $520 \pm 48$  g (435 g to 580 g). The experiment lasted 8 weeks. The animals were housed two per cage (5 animals/m<sup>2</sup>) or four per cage (10 animals/m<sup>2</sup>) in an open-sided cement block building. The cages were arranged in a two-tier manner made up of metallic wire mesh with 3 compartments each measuring 70 x 60 x 60 cm.

Animals were provided one of three types of feeders as follows (Figure 1): The metallic J-feeders measuring 40 cm long, 10 cm wide with maximum capacity of 1050 g of concentrated feed. The cylindrical metallic tin, with a height of 12 cm, circumference 37 cm, and an inward curvature at opening of 1.5 cm, and a feed capacity of 650 g. The Chinese bamboo feeder with opening measuring 40 cm by 10.5 cm and with feed capacity of 350 g.

### Feeding and diets

The rabbits were fed a corn-based non-pellet diet formulated to provide 2750

kcal/kg and 200 g crude protein per kg. This was supplemented with Guatemala grass (*Trypsacum laxum*) wrapped and tied in a bundle and put in the cages to increase the fiber level of the diet. The animals which had been fed on concentrate and green grass previously were given one week to adapt to the experimental conditions and feeders before recording feed intake, feed wastage and body weight change.

The animals were fed each morning at about 10.00 hours after having cleaned the feeders and weighing the remains. Similarly, fresh wilted grass was provided and the waste removed every morning. Water was provided to all animals in drinking cups *ad-lib*.

### Experimental design

The experiment was a 3x2x2 factorial design with 3 feeder types, 2 stocking rates (2 or 4 animals/cage or 5 or 10 rabbits per square meter) and 2 sexes. Animals were blocked by weight and randomly assigned to one of three types of feeders.

### Measurements

Animals were weighed individually at the start and weekly until the end of the experiment. This was carried out at the same period of the day. The weight of the



**Figure 1:** Different types of locally available feeders.

A: Metallic J. Feeder, 40 cm (H) x 10 cm (W), 1050 g of feed capacity.

B: Cylindrical Metallic tin, 12 cm (H) x 37 cm (cir), 650 g of feed capacity.

C: Chinese Bamboo, 40 cm (H) x 10.5 cm (W), 350 g of feed capacity.

concentrate offered was recorded each day. The left over feed and wasted concentrate were separately weighed and the weight subtracted from the initial weight of feed offered. Mortality rates were calculated from the number of animals which died on each treatment during the period of the experiment.

### **Statistical analysis**

Data collected were subjected to analysis of variance using (feeder type, stocking rate and sex) as main effects, following the general linear models (GLM) procedure of the Statistical Analysis System Institute (SAS, 1988). Where applicable, least square differences were used to determine significance ( $P < 0.05$ ) between treatments means (STEEL and TORRIE, 1980).

## **RESULTS**

### **Voluntary feed intake**

There was no significant effect of cage density on feed intake. However, increasing the cage density from 2 to 4 rabbits may stimulate feed intake (48.22 vs  $53.75 \pm 3.30$  g/animal per d,  $P = 0.08$ ) during the experimental period (Table 1). Similarly, the type of feed trough did not have a significant ( $P > 0.05$ ) effect on feed intake. Cylindrical metallic tin feeder may enhance feed intake compared to the Chinese bamboo and the J-feeders (58.98, 47.01 and  $46.95 \pm 4.66$  g/animal per d) ( $P = 0.08$ ).

### **Feed wastage**

Stocking rate affected ( $P < 0.05$ ) feed wastage. When the number of animals increased from 2 to 4, feed wastage increased significantly ( $15.89$  vs  $11.74 \pm 0.70$  g/animal per d;  $P < 0.01$ ) (Table 1). There was a significant ( $P < 0.01$ ) effect of feeder type on feed wastage. Values obtained for daily feed wastage for the j-feeder, Chinese bamboo trough and metallic tins were 24.12, 14.06 and  $3.26 \pm 0.86$  g/animal per d,

respectively (Table 1).

### **Live-weight change**

Animals kept two per cage had a significantly ( $P<0.01$ ) higher final body weight compared to those housed 4 per cage (1415 vs 1273  $\pm$  15 g/animal, Table 1). The effect of cage density on daily weight gains of animals showed a similar trend as animals caged in pairs recorded significantly ( $P<0.05$ ) higher daily body weight gains (15.00 vs 12.46  $\pm$  0.66 g/animal per d) than those in fours. Live weight was not affected ( $P>0.05$ ) by feeder type (Table 1).

### **Feed conversion efficiency**

Neither cage density nor feeder type had a significant effect on feed conversion efficiency ( $P>0.05$ ).

### **Animal mortality**

No significant differences on mortality were found by increasing the density of animals from 2 to 4 per cage ( $P>0.05$ ). No differences on mortality were found when comparing feeder type ( $P>0.05$ ) (Table 1). However it should be noticed that the number of rabbits is too low to study this effect.

### **Effect of sex on productive performance**

The effect of sex on all parameters measured is shown in Table 2. There was no significant ( $P>0.05$ ) effect of sex on feed intake, weight gain, final body weight gain, feed conversion efficiency, feed wastage and mortality rate. Similarly, the cumulative effect of sex and density had no significant ( $P>0.05$ ) interactive effect on all the parameters except feed wastage where animals on the J-feeder had the highest feed waste for both sexes ( $P<0.05$ ).

### **Effect of treatment interaction on productive parameters**

The interaction between cage density, feeder type and sex showed no significant effects on feed intake, daily weight gain, feed efficiency, final weight gain and mortality rate. Feed wastage was influenced ( $P<0.01$ ) by the combined effect of

density, sex and feeder type with feeder type being the most dominant factor. As indicated in Table 1, feed wastage decreased significantly ( $P<0.01$ ) from the j-feeder to the cylindrical metallic tin feeder.

## DISCUSSION

The significant higher daily weight gains recorded in rabbits housed in pairs per cage (5 rabbits/m<sup>2</sup>) was an indication of a superior growth performance over those rabbits housed four per cage (10 rabbits/m<sup>2</sup>). Better growth performance by rabbits housed in pairs could be attributed to the availability of more cage space per animal and reduced cage crowding which enhanced welfare and comfort, the efficiency of feed utilization and productivity. These findings are consistent with those of MAERTENS and GROOTE (1984) who kept 5 week old rabbits in mesh cages for six weeks, and observed greater mean daily gain and feed intake for rabbits kept 3 or 4 per cage (11.6 or 15.4 rabbits/m<sup>2</sup>) than for those kept 5 or 6 per cage (19.3 or 23.2 rabbits/m<sup>2</sup>). In other studies, the same authors reported that rabbits housed individually had better daily gains than those housed in groups. Elsewhere, AUBRET and DUPERRAY (1992, 1993) in similar studies stocked Hy-plus rabbits in wire cages at 5 densities varying from 16.9 to 28.2 rabbits/m<sup>2</sup>) and observed significant decrease in daily gain to slaughter from 43.6 g to 40.3 g, respectively. However, LAMBERTINI *et al.* (2001) showed that caged and pen-raised rabbits kept at lower stocking densities had significant higher growth rates and carcass weight than those kept at higher stocking densities. On the contrary, OLIVEIRA and ALMEIDA (2002) concluded that the increase in stocking density from 11.67 to 16.67 rabbits/m<sup>2</sup> (7 to 10 rabbits/cage) had no effect on daily weight gains, daily ration consumption and feed efficiency of growing rabbits. Even though these studies showed no effect of stocking density on the performance of rabbits, most research findings are consistent in that increasing the stocking density of rabbits results in a decrease in daily gains. AUBRET and DUPERRAY (1992), concluded that growth rates of rabbits may be reduced when stocking density is greater than 19.8 rabbits/m<sup>2</sup> or when they reach 40kg/m<sup>2</sup> cage area (MAERTENS and GROOTE, 1984). This notwithstanding, the results of this study

**Table 1:** Effect of cage density and feeder type on production traits of weaning rabbits.

	Cage Density			Feeder Type			Significance			
	D2 (5 rabbits/m <sup>2</sup> )	D4 (10 rabbits/m <sup>2</sup> )	SEM	J-feeder	Chinese bamboo trough	Metallic tin	SEM	Density	Feeder	Feeder x density
Feed intake (g/d)	48.22 <sup>a</sup>	53.75 <sup>a</sup>	3.30	46.95 <sup>a</sup>	47.01 <sup>a</sup>	58.98 <sup>a</sup>	4.66	NS	NS	NS
Feed waste (g/rabbit)	11.74 <sup>a</sup>	15.89 <sup>b</sup>	0.70	24.12 <sup>a</sup>	14.06 <sup>a</sup>	3.26 <sup>c</sup>	0.86	*	**	NS
Weight gain (g/rabbit per d)	15.00 <sup>a</sup>	12.46 <sup>b</sup>	0.66	13.31 <sup>a</sup>	14.52 <sup>a</sup>	13.36 <sup>a</sup>	0.81	**	NS	NS
Final body weight (g/rabbit)	1415 <sup>a</sup>	1273 <sup>b</sup>	15	1320 <sup>a</sup>	1388 <sup>a</sup>	1323 <sup>a</sup>	18	**	NS	NS
Feed conversion efficiency	3.19 <sup>a</sup>	3.53 <sup>a</sup>	0.26	3.66 <sup>a</sup>	3.55 <sup>a</sup>	4.41 <sup>a</sup>	0.32	NS	NS	NS
Mortality rate (%)	16	35		25	29	33		NS	NS	NS

D2: 2 rabbits per cage; D4: 4 rabbits per cage.  
Means within a row with different superscripts differ ( $P < 0.05$ ).

\*  $P < 0.05$ , \*\*  $P < 0.01$

SEM = standard error of the mean.

NS = not significant.

indicate a significant lower growth rate of rabbits at a stocking density of 10 rabbits/m<sup>2</sup>. This is consistent with other observations which suggest that the fewer the number of rabbits housed per cage, the better the daily weight gains; rabbits housed individually had higher daily weight gains than those housed in groups (MAERTENS and GROOTE, 1984).

Feed intake was not affected in this study by increasing stocking density. Even though this contradicts other reports which indicated that feed intake was decreased with increase in stocking density (MAERTENS and GROOTE, 1984; AUBRET and DUPERRAY, 1992), these findings are consistent with those of OLIVEIRA and ALMEIDA (2002) who found no effect of increase in stocking density on rabbit performance (final body weight, daily weight gain, daily ration consumption, feed conversion efficiency and mortality). The availability of more space to rabbits housed 2 per cage (5 rabbits/m<sup>2</sup>) in this study, and the reduced interference from other animals

**Table 2:** The effect of sex on production traits of rabbits reared using two cage densities and three feeder types.

	SEX			LEVEL OF SIGNIFICANCE			
	Male	Female	SEM	Sex	Density x Sex	Feeder x Sex	Feeder x Sex x Density
Feed intake (g/animal per d)	48.82	53.15	3.80	NS	NS	NS	NS
Weight gain (g/animal per d)	13.99	13.47	0.65	NS	NS	NS	NS
Final body weight (g/rabbit)	1358	1329	15	NS	NS	NS	NS
Feed conversion efficiency	3.44	4.31	0.26	NS	NS	NS	NS
Feed waste (g/animal per d)	13.34	14.17	0.70	NS	NS	NS	NS
Mortality rate (%)	36	22		NS	NS	NS	NS

\* $P < 0.05$ , \*\* $P < 0.01$

SEM: standard error of the mean.

NS: not significant.



might have resulted in enhanced welfare and daily weight gains than observed for rabbits housed 4 per cage (10 rabbits/m<sup>2</sup>).

Feed wastage was highly affected by increasing the number of rabbits from two to four in a cage. This could be due to the combined phenomena of the animals struggling to establish dominance and scrambling to have access to feed, which invariably would have caused more feed spilled out of the feeders. The former phenomenon was observed with other species by SHERRIT *et al.*, (1974) who showed that when weaned pigs from several litters were mixed, there was a short period of stress until a dominance order had been established, but this did not appear to affect voluntary feed intake.

We did not find significant effects of mortality and feed conversion efficiency in this study. This is consistent with previous reports (MAERTENS and GROOTE, 1984; AUBRET and DUPERRAY, 1992, 1993; OLIVEIRA and ALMEIDA, 2002) which indicated that an increase in stocking density of rabbits housed in cages had no effect on mortality and feed conversion efficiency.

Feed wastage was highly affected by feeder type. The limited feed wastage recorded for the cylindrical metallic tin feeder could be due to the circular opening of the tin which provided limited access to the trough, the circular in-folding at the top of the tin which served as some kind of anti spillage device, and to the cylindrical shape which could have helped in keeping the animals away from the feed during aggressive behavior from domineering animals. The high feed spillage by animals on the J and Chinese bamboo feeders could be attributed to their linear openings, which allowed access to all animals at the same time with each animal having a chance to spill feed. In practice, feed wasted during feeding by rabbit is not recovered and fed to animals because of faecal and urine contamination. This implies that the more feed wasted from a given feeder type, the more money the farmer loses and the higher the production cost.

The Chinese bamboo and the cylindrical metallic tin are cheap materials found

locally but are not popularly used in rabbit production. This study has shown the usefulness of these materials and how they could be utilised in rabbit feeding management systems in the rural areas of the country. In addition, these results suggest that when rabbits are reared in pairs and using cylindrical metallic tins as feeders, better animal performance and minimum feed wastage could be achieved.

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