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Effect of supplementary feed and stocking rate on the production of ostriches grazing irrigated lucerne pasture

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Abstract

This study was conducted to determine the effect of two different levels of supplementary feed and two different stocking rates on the production of grazing ostriches. One hundred and seventy ostriches were randomly allocated to four groups and kept on irrigated lucerne pasture with or without supplementary feed from approximately 58 kg to a target weight of 95 kg. The ostriches rotationally grazed lucerne pasture at one of two stocking rates, i.e. 15 birds/ha or 10 birds/ha and were fed one of two levels of supplement i.e. 0 g or 800 g feed/d formulated according to the nutrient requirements of the relevant group of birds. Data were analyzed by ANOVA. There was no interaction between the supplementary feed and stocking rate regarding mean live weight at 54 weeks of age and feed conversion ration (FCR). Data were provided as the two main effects of level of supplementation and stocking rate. Significant differences in mean live weight at 54 weeks of age and FCR of the birds were observed between the different levels of supplementary feed. The parameters measured for the two different stocking rates used in this study (10 birds/ha *vs*. 15 birds/ha) did not differ from each other and did not influence either mean live weight at 54 weeks of age, average daily gain (ADG) or FCR. The two groups which received 800 g supplementary feed/d reached slaughter weight (95 kg) within the set of 54 weeks of grazing for the trial, while the two groups which received no supplementary feed did not achieve slaughter weight by 54 weeks on the pasture. Ostriches receiving supplementation of 800 g/bird/day had significantly better FCR's than birds receiving no supplementation. There was a significant interaction between level of supplementary feed and stocking rate regarding ADG of the birds. As stocking rate increased, average daily gains of birds receiving no supplementary feed declined. This study indicates that ostriches being kept on grazing and receiving supplementary feed will exhibit improved and faster growth rates than ostriches which only have access to grazing and receive no supplementary feed.

Keywords: Alfalfa, nutrition, free-range, ratite, slaughter weight, growth, average daily gain, weight change
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Introduction

Natural and cultivated grazing provides most of the feed eaten by our livestock and, due to the fact that it is also the cheapest form of feed for animals, grazing is and will always be very important. As human population pressures grow and food suitable for humans become less available for animals, grazing will become increasingly important (Williams, 1981). There are a number of advantages to using grazing forages for animal production systems, including reduced feed costs, allowing animals to exercise with the potential of better meat quality, provision of extra nutrients to the animals, lower initial capital investment, better use of land less suitable for cropping, decreased antagonistic behaviour among animals, improved animal welfare and a favourable environmental perception (Rachuonyo *et al.*, 2005). In most monogastric animal production systems, some kind of grain is the main energy ingredient in the formulated diet. In future, it is possible that these animal production systems (like ostrich systems) will compete directly with humans for cereal grains and high-quality protein supplements. The limiting grain supplies can in the future pressurize producers to feed significant quantities of feedstuffs that are not suitable for human consumption. These feedstuffs include hull or bran fractions of seeds as well as legume and grass pastures. These feedstuffs can potentially be used to feed reproducing swine and ostriches (Varel & Yen, 1997). Scientists suggested that the use of forages can lead to less grain use, which would decrease feed resource needs, expense and storage, and hence it will decrease production costs. Another benefit of highly palatable forages with high intake potentials (like lucerne) is that it can decrease the proportion of concentrates in the diet, thereby minimizing imports of feed, feeding costs and resulting in lower nutrient and manure load on the environment (Rachuonyo *et al.*, 2005).

The most common cultivated pasture used for grazing ostriches is lucerne (Brand & Gous, 2006). Lucerne hay is a popular source of roughage in ostrich diets and most ratite feeds are lucerne-based with additions of maize, wheat middlings, oats, soyabean hulls and brewers dried grains (Cooper & Horbanczuk, 2004). In the regions of southern Africa where irrigation is required, (like the winter rainfall region of the Western Cape), lucerne often forms the staple diet of ostriches (Swart & Kemm, 1985). Ostriches are currently reared under a wide range of stocking rates, ranging from 16 – 40 m^2 per bird (Verwoerd *et al.*, 1999). Smit (1964) estimated that one ostrich can be run on five hectares of good Karoo veld while on bad Karoo veld, 10 – 12 ha are required per bird. Smit (1964) also stated that lucerne could be grazed at a stocking rate of 8 – 12 ostriches per hectare, depending on rainfall. Under irrigation, 10 birds per ha are allowed. According to Maree (1979), 0.43 ha lucerne under irrigation can carry five ostriches. This will depend on the quality of the pasture as well as the age of the birds. Nel (1993) stated that birds on lucerne pastures can be stocked at a rate of 6.5 birds per ha. According to Mellett (1993), when practicing a system of alternative grazing, the carrying capacity of lucerne pastures is eight ostriches per hectare.

Efficient growth and optimal weight gain cannot be attained without a nutritionally balanced ration (Allden, 1981). Although lucerne is one of the most palatable forage crops for livestock, the digestible energy level and amino acid content of lucerne is too low to support the nutrient requirements of growing ostriches under extensive to semi-intensive systems, and therefore it needs to be supplemented (Zeeman, 1980). In a previous study done on grazing ostriches, it was found that ostriches grazing irrigated lucerne pasture and receiving 1500 g supplementary feed/day had better growth rates ($P \leq 0.05$) than ostriches which received 1000 g, 500 g or 0 g supplementary feed/bird/day. It was evident that birds grew according to the amount of feed used to supplement the lucerne pasture (Strydom *et al.*, 2007). However, not only level of supplementation, but also stocking rate can influence the successful rearing of ostriches on pasture (Brand, 1996). Achieving the optimum balance between the number of animals and pasture production must be the main objective of any grazing system (Cloete *et al.*, 1992). Increased grazing pressure is generally associated with a decrease in yield per animal when optimum stocking rates are exceeded (Brand, 1996). This study was done to evaluate the effect of two different levels of supplementation and stocking rates on the production performance of ostriches.

Materials and Methods

The study was conducted at the Kromme Rhee Experimental Farm in the Western Cape Province of South Africa near Stellenbosch. One hundred and seventy ostriches (average age of six months) and of mixed gender were randomly divided into four groups. The groups rotationally (i.e. a 5-week rotation system) grazed irrigated lucerne pastures. Two groups contained 50 ostriches each and the other two groups contained 35 ostriches each, thus providing stocking rates of 15 ostriches/ha and 10 ostriches/ha respectively. One group of 50 ostriches and one group of 35 ostriches received 800 g supplementary feed/bird/day while grazing lucerne and the remaining two groups received no supplementary feed. The supplementary feeding mixture was formulated according to the birds' nutrient requirements at six months of age (MIXIT-2™, 1982). Table 1 represents the ingredient composition of the supplementary feed. The ostriches in all four groups were weighed before they started grazing lucerne and thereafter the birds were weighed each time they were moved to a new camp. The ostriches in each camp were only moved once there was no more grazing left in the current camp. Data recorded included mean live weight at the end of the trial, average daily gain (ADG) and feed conversion ratio (FCR). The experiment was a complete randomized design with two main factors of two supplementary feed treatment levels, i.e. 0 g/bird/day and 800 g/bird/day and two stocking rates, i.e. 10 birds/ha and 15 birds/ha. The Proc GLM (SAS 9.1.3 for Windows, 2002 – 2003) was used to analyze the growth of the ostriches.

Results and Discussion

Results are presented in Table 2.

The multiple analysis of variance showed that there was no interaction (P >0.05) between level of supplementary feed and stocking rate for either mean live weight at 54 weeks (P = 0.16) and FCR (P = 0.68).

Table 1 Ingredient and chemical composition of the supplementary feed given to finish ostriches grazing irrigated lucerne pastures

Ingredients (kg/ton as fed)	
Maize	758
Soyabean oilcake meal	127
Calorie 3000 (Molasses power)	30
Monocalcium phosphate	27
Limestone	23
Ostrich finish premix	10
Salt	25
Chemical composition (as fed basis)	
$TME_{ostriches}$	13.46 MJ/kg feed
Crude protein	121.5 g/kg
Lysine	5.4 g/kg
Methionine + Cystine	4.4 g/kg
Threonine	4.4 g/kg
Tryptophan	1.4 g/kg
Arginine	6.9 g/kg

TME – true metabolisable energy.

Table 2 Mean live weight (kg), average daily gain (ADG g/day) and feed conversion ratio (FCR kg feed ingested to gain 1 kg of weight) of ostriches subjected to two different levels of supplementary feed and two stocking rates. Values are mean ± s.e. of the mean

Effect of supplementary feeding level	Mean live weight at 54 weeks (kg)	ADG (g/day)	FCR (kg feed to g gain 1 kg of weight)
0 g/bird/day	$82.7^{b} \pm 0.84$	$117.9^{b} \pm 4.00$	$10.9^{a} \pm 0.29$
800 g/bird/day	$98.9^{a} \pm 0.88$	$195.1^{a} \pm 4.24$	$9.6^{b} \pm 0.23$
Effect of stocking rate			
10 birds/ha	$91.5^{a} \pm 1.29$	$163.7^{a} \pm 5.59$	$9.9^{a} \pm 0.24$
15 birds/ha	$90.9^{a} \pm 1.21$	$153.9^{a} \pm 5.98$	$10.3^{a} \pm 0.28$

[a,b,c] Row means with common superscripts differ significantly at P <0.05.

Data is therefore provided as the two main effects of level of supplementary feed and stocking rate. Supplementary feeding level had a significantly different (P <0.05) effect on mean live weight at 54 weeks (P <0.01) and FCR (P = 0.01). Ostriches receiving 800 g supplementary feed/bird/day reached the target weight (95 kg) within the period of the trial, but the ostriches receiving no supplementary feed while grazing lucerne did not reach target slaughter weight within the allocated period of time. Ostriches receiving 800 g supplementary feed/bird/day reached a mean live weight of 98.9 kg, while ostriches receiving no supplementary feed only reached a mean live weight of 82.7 kg. Ostriches receiving 800 g supplementary feed/bird/day had a FCR of 9.6 kg feed/kg weight gain and this was significantly better than the FCR of the ostriches receiving no supplementary feed (10.9 kg feed/kg weight gain). Stocking rate did not have an effect (P >0.05) on either mean live weight at 54 weeks (P = 0.4474) or FCR (P = 0.4143). The only previous study involving stocking rate in ostriches was done by Cornetto *et al.* (2003) and this study was done on starter ostrich chicks aged 21 to 98 days and also did not include different levels of supplementary feeding. The result of the current study is in contrast to what was found by Cornetto *et al.* (2003) as they found that as the stocking rate increases, final live body weights of ostrich chicks decline. They did, however, find that stocking rate did not influence the FCR of the ostrich chicks, which is in accordance with the current study. In the study of Strydom *et al.* (2007) different levels of supplementary feeding were provided to finish ostriches grazing irrigated lucerne pastures. These ostriches were stocked at a stocking rate of 15 birds/ha and they received either 1500 g, 1000 g, 500 g or 0 g supplementary feed/bird/day. Birds subjected to a stocking rate of 15 birds/ha and receiving 500 g supplementary feed/bird/day reached a mean live weight of 88.4 kg within 205 days of the commencement of the trial and had a FCR of 8.9 kg feed to gain 1 kg weight. Birds receiving 1000 g supplementary feed/bird/day reached a mean live weight of 96.9 kg within 154 days and their FCR was 8.7 kg feed to gain 1 kg weight. This is comparable to the ostriches in the current study receiving 800 g supplementary feed/bird/day, which reached a mean live weight of 98.9 kg within 201 days and had a FCR of 9.6 kg feed to gain 1 kg weight. The FCR of the ostriches in the current study was, however, much poorer than the FCR's of birds in the previous study. This could possibly be due to the fact that the ostriches in the first study were approximately seven months old at the start of the experiment and were slaughtered at 12.5 months of age, while the ostriches in the current study were approximately six months old at the start and were slaughtered at 13.5 months of age. The longer period of feed intake and growth for the ostrich in the current study could lead to the birds having a higher FCR (9.6 kg feed to gain 1 kg weight) than the birds in the first study (8.7 for the 1000 g/bird/day group and 8.9 for the 500 g/bird/day group).

In the case of ADG, there was a significant interaction ($P < 0.05$) between level of supplementary feed and stocking rate ($P = 0.04$). This is illustrated in Figure 1.

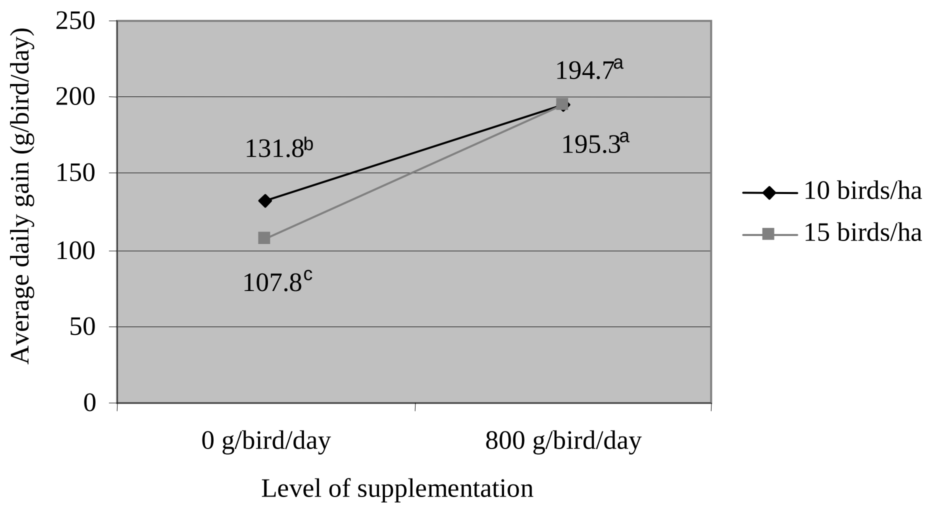

Figure 1 Mean average daily gains (g/day) reached by ostriches subjected to two different levels of supplementary feed and two different stocking rates ([a,b,c] Means with common superscripts differ significantly at $P < 0.05$).

At a stocking rate of 10 or 15 birds/ha, ostriches receiving 800 g supplementary feed/bird/day did not have significantly different ADG's, but if ostriches received no supplementation, the ostriches on the lower stocking rate of 10 birds/ha reached significantly higher ADG's than birds on the higher stocking rate of 15 birds/ha. Therefore it can be concluded that stocking rate influenced ADG when birds did not receive any supplementary feed, but if birds received 800 g supplementary feed/bird/day, stocking rate did not influence ADG of the birds. As stocking rate increases, average daily gains of birds receiving no supplementary feed declines. This negative linear relationship between ADG and stocking rate when animals receive no supplementation agrees with numerous studies done on grazing ruminants. Van Heerden & Tainton (1987) showed this trend with sheep on lucerne and medic pastures in South Africa, De Villiers *et al.* (1994) with lambs on kikuyu grazing, Relling *et al.* (2001) with sheep on tropical pastures, Animut *et al.* (2005) with sheep and goats on a grass/forbs mixed pasture and Van Niekerk *et al.* (2006) with lambs on a perennial irrigated pasture. This negative linear trend is mainly due to the fact that at high stocking rates, the feed intakes of animals are restricted because of limited pasture availability and limited opportunity to select the more nutritious plant parts in the pasture. Therefore the animals' performance will naturally deteriorate (Van Niekerk *et al.*, 2006). This will be even more so in the case of ostriches because of the way in which they graze, which is by stripping the branches of their leaves. The leaves are the most nutritious parts of the plants (Van Niekerk, 1995).

Conclusion

This study indicates that ostriches being kept on irrigated lucerne pasture and receiving supplementary feed balanced according to the nutrient value of the lucerne and the requirements of the animals will show improved growth rates compared to ostriches which only have access to grazing and receiving no supplementary feed. Stocking rate, as used in this study, revealed no differences in growth and production. In future it may be necessary to graze ostriches at higher stocking rates to determine optimum stocking rates versus supplementary feeding levels.

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