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

M. Strydom\textsuperscript{1,2}, T.S. Brand\textsuperscript{1,2}, B.B. Aucamp\textsuperscript{1} and J.M. van Heerden\textsuperscript{3}

\textsuperscript{1} Institute for Animal Production: Elsenburg, Western Cape Department of Agriculture, Private Bag X1, Elsenburg 7607, South Africa
\textsuperscript{2} Department of Animal Science, University of Stellenbosch, Private Bag X1, Matieland 7602, South Africa
\textsuperscript{3} Agricultural Research Council, Private Bag X5026, Stellenbosch 7599, South Africa

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 \textit{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.

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 \textit{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 South African Journal of Animal Science is available online at http://www.sasas.co.za/sajas.asp
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 – true metabolisable energy.  | 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 |

**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 ± 0.84                      | 117.9 ± 4.00 | 10.9 ± 0.29                           |
| 800 g/bird/day                       | 98.9 ± 0.88                      | 195.1 ± 4.24 | 9.6 ± 0.23                            |
| Effect of stocking rate              |                                  |             |                                       |
| 10 birds/ha                          | 91.5 ± 1.29                      | 163.7 ± 5.59 | 9.9 ± 0.24                            |
| 15 birds/ha                          | 90.9 ± 1.21                      | 153.9 ± 5.98 | 10.3 ± 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](http://www.sasas.co.za/sajas.asp)

**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.

References

Allden, W.G., 1981. Energy and protein supplements for grazing livestock. In: World Animal Science B1: Grazing Animals. Ed. Morley, F.H.W., Elsevier Scientific Publishing Company, Amsterdam, The Netherlands. pp. 289-307.

Animut, G., Goetsch, A.L., Aiken, G.E., Puchala, R., Detweiler, G., Krebbl, C.R., Merkel, R.C., Sahlu, T., Dawson, L.J., Johnson, Z.B. & Gipson, T.A., 2005. Performance and forage selectivity of sheep and goats co-grazing grass/forb pastures at three stocking rates. Small Rumin. Res. 59, 203-215.

Brand, T.S., 1996. The nutritional status and feeding practices of sheep grazing cultivated pasture and crop residues in a Mediterranean environment. Ph.D. thesis, University of Stellenbosch, South Africa.

Brand, T.S. & Gous, R.M., 2006. Feeding ostriches. In: Feeding in Domestic Vertebrates: from Structure to Behaviour. Ed. Bels, V., CAB International, Oxfordshire, U.K. pp. 136-155.

Cloete, S.W.P., Brand, T.S. & Van Heerden, J.M., 1992. Sheep production from systems involving cultivated pastures in the Mediterranean area of South Africa: A perspective. Proceedings of the World and Wool Congress, 6 – 12 August, Buenos Aires, Argentina. pp. 1-23.

Cooper, R.G. & Horbanczuk, J.O., 2004. Ostrich nutrition: A review from a Zimbabwean perspective. Rev. Sci. Technol. Off. Int. Epiz. 23 (3), 1033-1042.

De Villiers, J.F., Botha, W.A. & Wandrag, J.J., 1994. The performance of lambs on kikuyu as influenced by stocking rate and grazing system. S. Afr. J. Anim. Sci. 24, 133-139.

Maree, P.C.J., 1979. Lucerne utilization by ostriches. Lucerne H.4/1979.

Mellett, F.D., 1993. Ostrich production and products. In: Livestock production systems, principles & practice. Eds Maree, C. & Casey, N.H., Agri Development Foundation. pp. 187-194.

MIXIT-2™, 1982. A Least-cost Feed Mix Program. Agricultural Software Consultants, Inc., Kingsville, TX.

Nel, J.C., 1993. Pasture utilization by ostriches. Report on the Ostrich industry in South Africa. Oudtshoorn Development Centre, Private Bag, Oudtshoorn, South Africa. pp. 20-21.

Rachuonyo, H.A., Allen, V.G. & McGlone, J.J., 2005. Behaviour, preference for, and use of alfalfa, tall fescue, white clover, and buffalo grass by pregnant gilts in an outdoor production system. J. Anim. Sci. 83, 2225-2234.

Relling, E.A., Van Niekerk, W.A., Coertze, R.J. & Rethman, N.F.G., 2001. An evaluation of Panicum maximum cv. Gatton: 1. The effect of stocking rate and period of absence on the production of sheep. S. Afr. J. Anim. Sci. 31, 77-83.

SAS, 2002-2003. SAS/STAT Version 9.1.3. SAS Institute Inc, SAS Campus Drive, Cary, North Carolina 27513, USA.

Smit, D.J.v.Z., 1964. Ostrich farming in the Little Karoo. South African Department of Technical Services, Bulletin No 358. pp. 46-56.

The South African Journal of Animal Science is available online at http://www.sasas.co.za/sajas.asp
Strydom, M., Brand, T.S., Aucamp, B.B. & Van Heerden, J.M., 2007. The effect of supplementary feeding on the production of grazing ostriches (*Struthio camelus*). Proceedings of the Special Mini Congress of South African Society for Animal Science, Klein Kariba, Bela Bela, 25-27 July 2007. Abstract

Swart, D. & Kemm, E.H., 1985. Die invloed van dieetproteïen- en energiepeil op die groei- en veerproduksie van slagvolstruise onder voerkraaltoestande. S. Afr. J. Anim. Sci. 15, 146-150 (in Afrikaans, Abstract in English).

Van Heerden, J.M. & Tainton, N.M., 1987. Potential of medic and lucerne pastures in the Rûens area of the Southern Cape. Grasslands Society of South Africa 3, 95-99.

Van Niekerk, B.D.H., 1995. The science and practice of ostrich nutrition. Proceedings of the AFMA Conference, June, Pretoria, South Africa. pp. 1-8.

Van Niekerk, W.A., Hassen, A., Casey, N.H. & Coertze, R.J., 2006. Effect of different grazing pressures by lambs grazing *Lolium perenne* and *Dactylis glomerata* pastures during spring on: 2. Intake and growth. S. Afr. J. Anim. Sci. 36 (5), Suppl. 1, 50-53.

Varel, V.H. & Yen, J.T., 1997. Microbial perspective on fibre utilization by swine. J. Anim. Sci. 75, 2715-2722.

Verwoerd, D.J., Deeming, D.C., Angel, C.R. & Perelman, B., 1999. Rearing environments around the world. In: The Ostrich: Biology, Production & Health. Ed. Deeming, D.C., CAB International, Oxon, United Kingdom. pp. 191-216.

Williams, O.B., 1981. Evolution of grazing systems. In: World Animal Science B1: Grazing Animals. Ed. Morley, F.H.W., Elsevier Scientific Publishing Company, Amsterdam, The Netherlands. pp. 1-12.

Zeeman, P., 1980. The nutritive value of lucerne. Farming in South Africa. Lucerne H.1/1980.