

# OstrichManual



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# Ostrich Manual

*The opinions expressed in this manual are not necessarily the opinions of the Western Cape Department of Agriculture, nor of the Ostrich Business Chamber.*

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# 1 | Introduction

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The ostrich (*Struthio camelius*) is a member of the ratite family (*flightless birds*). The ostrich is indigenous to Africa, Syria and Arabia; at present wild ostriches are only found in Africa.

Jan van Riebeeck documented large flocks of ostriches roaming the Cape in 1652. In 1821, the Cape Colony exported 1 230kg of wild ostrich feathers. At the time, wild ostriches were hunted and killed for their plumes. A year later, 1822, the Cape Colony made proclamations to protect wild ostriches from being hunted to extinction. By 1858, only 915kg of wild ostrich feathers were exported but at a significantly higher price due to the demand.

The first wild ostrich was tamed in 1863. A new branch of agriculture was established in the Karoo and Eastern Cape due to the farming of tamed ostriches. A severe drought in 1865 was an incentive for farmers to keep ostriches, which are adapted to survive in arid areas, in order to supplement their income. A Cape Colony census reported 80 domesticated ostriches in that year. Arthur Douglass, a self-described pioneer ostrich farmer in the Albany district of the Eastern Cape, designed the first prototype incubator for ostrich eggs called "The Eclipse" in 1869. Improvements to the incubator contributed to an increase in ostrich chick production. Mr Douglass also identified wireworm and wrote the first book on ostrich farming published in 1881 titled "Ostrich Farming in South Africa".

Lucerne was also introduced by the then magistrate of Oudtshoorn, Mr Scholtz, who imported the seed and planted a small plot to feed his ostriches. The feather auctions were started in Mossel Bay in 1870. Ostriches were imported from Northern Africa in 1874 to improve feather quality through crossbreeding.

The period between 1875 and 1880 is often described as the **First Ostrich Boom**. During this period, there were 32 247 farmed ostriches according to a Cape Colony census, with ostriches becoming the 4th most valuable agricultural product after tobacco, viticulture and wheat. Ostrich farming was very lucrative business and farmers accumulated wealth rapidly. In 1882, the export value of ostrich feathers reached its highest level ever. In 1884, the Cape Government imposed heavy export taxes on live birds to protect the local industry. A year later (1885) there was a collapse in the market price of feathers due to over-production and poor feather quality. Many farmers





were faced with bankruptcy but many continued to farm with ostriches hoping that the market would improve.

A decision was made to import wild ostriches from Barbary (North African red neck *Struthio camelus camelus*) in 1886 (and again in 1888 and 1903) to improve the local strains (native South African Blue neck, *Struthio camelus australis*) to produce the South African black neck, *Struthio camelus domesticus*. By 1890, breeders began to use selection, crossbreeding and rigid culling to improve feather quality, when ostriches were again imported to enhance local bloodlines. In 1885, there were 253 463 domesticated ostriches according to a Cape Colony census. The **second ostrich (feather) boom** started in 1897. By then most ostrich farms were concentrated in Oudtshoorn, Grahamstown, Cradock and Graaff Reinet with Port Elizabeth the headquarters of the feather export business. Land prices rose significantly and “feather palaces” were built. The newfound wealth also meant that farmers could afford to build steel fences and irrigate their farms. The Lucerne industry started to develop in earnest. The second Anglo-Boer War (1899 – 1902) had an indirect adverse effect on the industry; feathers could not be moved to auctions. The feather trade improved once again after the war ended and some of the most opulent of the feather palaces in Oudtshoorn were built.

In 1907 a law was passed that made the illegal export of live ostriches punishable by a jail term of 1-2 years, with hard labour, in attempts to protect the local industry.

In 1913, ostrich feathers were the 4th largest export from the Union of South Africa after gold, diamonds and wool. Government passed laws to prevent the extinction of exotic and rare birds in 1913 which affected the practices of the ostrich industry. The advent of World War I had an enormous impact on the global socio-economic situation which had favoured ostrich plumes for half a century and producers did not foresee the feather trade recovering from the slump. The Great War marked the collapse of the ostrich feather industry and the beginning of the decline of the feather trade. Logistical difficulties with sea freight during the war made export difficult. The invention and manufacture of the automobile by the Ford Motor company further contributed to ostrich feathers going out of fashion; ornate hats became impractical. Fashion, a fickle business, had changed and ostrich feathers were passé. An estimated 80% of ostrich farmers lost their livelihoods in this period.

The “*Suid-Afrikaanse Volstruisboere Koöperasie Beperk*” was established in 1926 in an attempt to develop the industry, regulate the market and stabilise prices. However, this organisation failed as the decline in feather demand continued. The number of ostriches declined from one million to 23 000 in 1930. Only the best breeding birds (in terms of feather quality) were kept.





In the 1940's, the quality of ostrich hides for leather products was discovered and led to a resurgence of interest in ostriches as a commercial farming enterprise. The Klein Karoo Agricultural Co-operative was established in Oudtshoorn in 1945 to regulate the industry and set the quality standards for ostrich products. On 1 August 1959 the Co-operative gained control over all ostrich products in South Africa under the Co-operatives Act. The industry was once again protected by law; this time as a national asset. A single channel marketing system was introduced for feathers and later applied to ostriches for slaughter and hides. Similar to the 1907 law; it was illegal to export any ostrich genetic material as eggs or live birds from South Africa.

The first private abattoir, opened in 1950, was taken over by the Co-operative in 1958. Ostrich meat products became popular and resulted in a boom in the trade of biltong (Dried meat). Ostrich meat also became recognised as a credible competitor in the red meat market. The Co-operative opened its first Ostrich Abattoir buildings in 1964 and a leather tannery was established in 1970. The single channel marketing through "*Klein Karoo Landbou Koöperasie (KKLK)*" was broadened to include all ostrich products in 1981 and also breeding material in 1988.

The ostrich farming industry was deregulated in 1993 by the Minister of Agriculture on request of the Klein Karoo International. This resulted in a free market system for the ostrich industry and allowed new participants the freedom to start their own value-adding ventures. During 1993 the first ostrich meat abattoir for export to Europe was built. This was a new challenge to ostrich production as the abattoirs had to comply with the sanitary and phytosanitary requirements for the export of meat. Furthermore, South African ostrich products had to compete on world markets with products from various other countries, including Australia, the USA, Israel and various European countries.

The establishment of the South African Ostrich Business Chamber (SAOBC), which supports the industry, played a significant role in providing direction in difficult times and ensuring that more serious problems are addressed and resolved effectively. The Ostrich Business Chamber currently represents all the role players in the ostrich industry nationally. Klein Karoo International still serves the industry as a private institution, providing marketing, slaughtering and financial support to its members. Other companies, such as Mosstrich, have been established to take care of slaughtering of ostriches, processing of hides, marketing of products and to support producers with advice.

The Western Cape Department of Agriculture has supported the ostrich industry through research since the establishment of the Oudtshoorn Research Farm in 1964. The contribution to the field has grown to the extent that the researchers of the





Directorate: Animal Sciences are presently world leaders in ostrich research, particularly in the field of ostrich nutrition and breeding. Current research initiatives aim to address problems in the industry with innovative scientific studies. Some of these projects include international collaborations to further expand the pool of expertise.

Veterinarians and Animal Health Technicians play a critical role in regulating export standards and monitoring, monitoring disease outbreaks and implementing biosecurity measures. Officials from both the National and Provincial Departments of Agriculture are responsible for these important duties. The Veterinarians of Klein Karoo International also perform exemplary work with the diagnosing of diseases and research; as well as advising producers on the prevention and treatment of diseases.

The 2004 and 2011 Avian Influenza outbreaks have posed a major challenge to producers. The implementation of strict biosecurity regulations will hopefully mitigate the effect of future outbreaks. The South African ostrich industry is no stranger to boom and recession periods and has proved to be resilient and innovative in its approach to these challenges. The industry is affected by volatile exchange rates since approximately 90% of the income is from export earnings. South African producers, however, continued to develop international markets through marketing their own products and encouraging innovative sales of ostrich products. The development of a local market contributed significantly in securing a stable market for ostrich meat.

The “*Volstruishandleiding*”, now in its second reprint since 2006 (revised in 2010) due to high demand; summarises the existing knowledge of ostrich farming in an accessible form. The authors are all experts in their fields and have shared their knowledge and novel research findings in the respective chapters.

At a Research Advisory Committee meeting in November 2008 it was decided that the “*Volstruishandleiding*” should be revised and translated into English. This is the first edition of the promised translated and updated version of the Ostrich Manual. The economics chapter has been rewritten to reflect the current status of the industry. A new chapter on biosecurity has been added to address this key issue. The chapter on reproduction management of breeding birds has been updated with new research on artificial insemination technologies currently being investigated. We sincerely hope that this first English edition of the revised and updated Ostrich Manual will also bring our information to more interested parties.







## 2 | Ostrich Farming Systems

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Long term planning is essential in ostrich farming and the farmer must have a thorough knowledge of the whole industry. Success in ostrich farming is largely dependent on the choices that are made, thus good management is critical.

The primary purpose of this chapter is to provide the necessary background on basic husbandry systems to the prospective farmer so that meaningful decisions can be made. A few common husbandry systems for rearing ostrich chicks are discussed below.

### Natural: Breeding Pairs

In this system one male and one female are placed in a breeding paddock of approximately 0.25 ha. The breeding pair is allowed to lay eggs, incubate them, and rear the chicks up to the age of three months. Full rations and water are provided in the paddock. It must be noted that breeding pairs differ in their breeding and rearing capabilities. These differences cannot be predetermined, but experience and keen observation, together with up-to-date and comprehensive records, can be used to identify good parent birds (*Refer to Ch. 7: Natural and artificial hatching of ostrich eggs for more info.*).

A maximum of 25 chicks can be reared by one breeding pair if no extra shelter is provided. The breeding pair will also rear chicks from other birds, provided that these chicks are the same size or smaller, than their own chicks.

### Breeding Pairs Plus Incubator

In this system, selected breeding pairs are allowed to incubate their eggs, whereas the eggs of other pairs are collected and artificially incubated (*Refer to Ch. 7: Natural and artificial hatching of ostrich eggs for more info.*). The chicks from the incubator are then added to the chicks incubated by the selected breeding pairs. In this instance the norm of 25 chicks per breeding pair still holds.

A variation of this system is to put more chicks (30-80) with individual breeding pairs and to provide shelter from bad weather and cold nights (*Refer to Ch. 9: The housing of ostrich chicks for more info.*). The success of such a system is largely dependent upon the type of housing and management, as breeding pairs by themselves are unable to shelter and take care of such a large number of chicks – especially during periods of inclement weather.





## Artificial Incubation Of Eggs

In this system all eggs are collected and artificially incubated. The eggs are collected from free-mating ostrich flocks of various sizes, breeding pairs or breeding trios (one male with two females). Scientific principles, record keeping and selection is currently only possible with one male and one female per breeding paddock. In practice, however, because of the high cost of establishing paddocks, breeding trios may be used and they also produce good results (*Refer to Ch. 7: Natural and artificial hatching of ostrich eggs for more info.*). Once the eggs have hatched, the chicks may be sold, or reared to the age of 3 to 6 months

## Artificial Rearing Of Ostriches

This system applies mainly to entrepreneurs who buy and rear chicks up to different ages, for example 0-3 months, 0-6 months, or to slaughter age. With artificial rearing of chicks, sustained good management is very important (*Refer to Ch. 8: Artificial rearing of chicks for more info.*). The correct feeding and proper care of the chicks with regard to temperature, hygiene and ventilation is of vital importance. The golden rule is to practice prevention, rather than to attempt to cure sick chicks.

Mortalities in artificially reared ostrich chicks aged between 0-3 months are usually ascribed to management issues. Entrepreneurs who decide to use this system should have good facilities, have enough time and be aware of the potential risks. Balanced feeding is provided ad lib, together with sufficient, clean drinking water.

After 3 months ostriches can be kept in flocks of 50 to 100 in feedlots of 0.5 to 1.0 ha until 10 to 14 months of age when they can be slaughtered at an ostrich abattoir.

During this phase ostrich herds may also be kept in pastures, if provided with some form of energy supplement.

## Feather Production

From 1863 to 1975 feather production was the main branch of ostrich farming. Since then the production of hides and meat has become the main focus, while the contribution of feathers to the gross income of a slaughter bird has declined to only 7-10%.

In a feather production system, the feathers of the slaughter bird are harvested once only, after slaughter, whereas feathers from mature birds are harvested and sold every seven to eight months. In the past, ostriches used for this purpose were kept mainly on Lucerne pasture. The change to leather and meat production in a feeding pen system, however, has adversely affected the production of feathers of good quality. However, there is still a healthy demand for good quality feathers (*Refer*





to Ch. 10: Slaughter-bird production and product quality for more info.).

## Summary

Ostrich farming consists of different systems – one or more of which can be practised concurrently on the same farm.

Considering factors such as farm size, farm location, climatic conditions and the skills of the manager, the appropriate system should be chosen for a specific enterprise. Because management plays such a vital role, the producer should decide which functions the ostrich should perform itself and which functions will be performed artificially, e.g. the incubation process and rearing of chicks.

From the age of three months to slaughter, factors such as farm size and availability of home-grown fodder will be of great importance in the choice of a specific system. Feed cost in this phase is the single most critical factor and may be as high as 70% of the total direct costs (*Refer to Ch. 13: Economic viability and financial management and Ch. 3: Ostrich nutrition guidelines for more info.*).

With regard to biosecurity it is important to limit movement of ostriches. In this aspect a closed system, where the chicks can be reared from day-old to slaughter, is the best option to prevent disease spread and risk (*Refer to Ch. 12: Health management and Ch. 13: Biosecurity in practice for more info.*).

There are experts who can support producers make the optimal choice for their own circumstances. Not only is it advisable to approach experts in the choice of a system during planning of an ostrich enterprise, but it is strongly recommended that experts are regularly consulted for advice – to ensure optimal profitability`.





### 3 | Ostrich Nutrition Guidelines

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#### Background

The ostrich is a monogastric animal and the nutritional requirements of the birds are defined according to these guidelines. The digestive tract of the ostrich comprises of the bill and beak, gullet (oesophagus), glandular stomach (proventriculus), stomach (ventriculus), small intestine (duodenum), large intestine (colon + caecum) and cloaca. The most important nutritional components that should be included in ostrich feeds are energy (carbohydrates and fat), protein (amino acids), minerals, trace elements and vitamins.

The most important elements in ostrich feeds that contain the necessary nutrients include energy sources (concentrates and roughage), protein sources, and mineral and vitamin mixtures. These basic constituents should be provided to the bird in the correct ratio to satisfy its specific needs at the various production stages, and in order to ensure optimal production and health. In many instances, birds are kept on pastures and shortages are supplemented by the provision of concentrated feed mixtures that are adapted to make up the shortfall in nutrients that the bird requires.

#### Nutritional Requirements

Commercial guidelines for the composition of ostrich feeds represent the minimum composition of feeds for different production stages of the bird. These guidelines are regulated by law (Law 36 of 1947) and are given in Table 3.1.

Various local studies have been done in the past few years to determine and refine the energy, protein and amino-acid requirements of ostriches. However, very little scientifically proven knowledge exists on the vitamin and mineral requirements of ostriches. In practice, data from other species are usually used when feed mixtures for ostriches are formulated.

#### Water Intake

Clean, good quality water should be available to birds at all times. It is particularly important that water given to chicks be of high quality. Water usage per day is approximately 2.5 l/kg dry feed. Production stage, housing, climate, type of feed, feed intake and type of pasture all play a role in daily water intake. However, in free-ranging conditions when the ostriches can find succulent plants, they seldom need to drink water.



**Table 3.1** Commercial guidelines for minimum composition of feeds for different production stages

Type of feed	Minimum crude protein (g/kg)	Minimum lysine (g/kg)	Maximum moisture (g/kg)	Minimum crude fat (g/kg)	Maximum roughage (g/kg)	Calcium		Minimum phosphate (g/kg)
						Min (g/kg)	Max (g/kg)	
Pre-Starter	190	10	120	25	100	12	15	6
Starter	170	9	120	25	100	12	15	6
Grower	150	7.5	120	25	175	10	16	5
Finisher	120	5.5	120	25	225	9	18	5
Slaughter bird	100	4	120	25	250	8	18	5
Maintenance	100	3	120	20	300	8	18	5
Breeder	120	5.8	120	25	240	25	30	5



## Nutrition Sources

In order to meet the nutritional needs of the bird, it is fed a balanced diet consisting of various basic components mixed in specific ratios. Table 3.2 explains the most common components used in ostrich feeds in South Africa. These components are fed as a supplement in the form of a concentrate to ostriches on pasture. Balanced ostrich diets, as well as supplements, should be made up as recommended by a qualified, registered animal nutritionist.

**Table 3.2** Most important components in ostrich feed

Concentrates	Roughage	Protein sources	Mineral sources	Other
Maize	Lucerne hay	Soybean	Feed lime	Synthetic lysine
Barley	Wheat bran	oilcake	Di-calcium phosphate	Synthetic methionine
Wheat	Oat bran	Canola oilcake	Mono-calcium phosphate	Plant oil
Triticale	Barley hay	Sunflower oilcake	Salt	Molasses products
Oats	Oat hay	Fish meal	Mineral- and vitamin pre-mix	Binding agents
Brewer's grain	Oat straw	Full fat soy (roasted)		Medicines (e.g. antibiotics)
	Wheat straw	Full fat canola		Additives (e.g. growth promoters, pre- and probiotics etc.)
	Silage	Sunflower seeds		
		Sweet lupins		
		Peas		
		Beans		
		Gluten		

## Feeding Strategies

Ostriches are reared extensively (i.e. birds are exclusively dependent on natural grazing and/or cultivated pasture), semi-intensively (i.e. birds foraging on natural veld or cultivated pasture and getting concentrate as supplement) or intensively (i.e. where a comprehensive balanced feed is provided).

Little research has been done on the utilization of natural veld as a feed source, although it is well known that foraging ostriches can destroy natural veld when the stocking density is too high. For this reason, in South Africa, ostriches for commercial slaughter purposes are not allowed to be kept on natural grazing. Breeding birds may, under certain conditions with the necessary supplements, be kept on natural grazing.

Lucerne is the most common cultivated pasture used for ostriches. Local studies suggest that the carrying capacity of





Lucerne pasture under irrigation is 10 birds per ha. Lucerne is generally used as pasture for young birds of 2 weeks to 3 or 4 months, after which they are usually moved to an intensive feeding system. It is, however, advisable to provide the birds with a supplement when cultivated pasture is used, in order to prevent any potential feeding deficiencies. Because foraging ostriches may have a destructive influence on grazing, either due to trampling or as a result of their feeding behaviour (by stripping the leaves from the stem of the plant), a system of no foraging is recommended. Instead, the Lucerne is harvested mechanically and fed as chopped green-fodder in the feeding paddocks, as the hay component of a balanced diet or as silage.

In South Africa 80% of the ostriches that are currently bred for slaughter purposes in the Little Karoo are intensively kept in feeding paddocks and 20% on pasture. In the southern Cape 60% of slaughter birds are reared on pasture and 40% intensively in feeding paddocks (personal communication, C. J. Nel, Oudtshoorn Research Farm, Oudtshoorn, South Africa). It is well known that ostriches do not thrive on grass-dominated grazing. In nature, ostriches will mainly survive on young blades of grass or they will eat grass seeds that are stripped from the inflorescence. Nevertheless, birds do well on pastures dominated by any kind of legumes, for example Lucerne, medics and seradella. Ostriches can also be successfully reared on canola pastures or even salt-bush plantations. Harvested grain fields and old fields are also successfully utilized by ostriches. Various types of weeds are well utilized by the birds.

The most common practice of ostrich production in South Africa is still the provision of a balanced diet to birds under intensive feeding conditions during certain or most of the production stages.

## Feeding Behaviour

The newly hatched ostrich chick is primarily dependent on its yolk sac, which disappears 10-14 days after hatching. The chick does not eat for the first 24-72 hours after hatching. Ostrich chicks are strong copiers of behaviour – they will copy their parents or other chicks in pecking objects or in selection of food. The practice to place chicks, that are already feeding, with new hatchlings, may help the hatchlings to start feeding, because of the copying behaviour. At first the feed should be strewn onto the ground, because new hatchlings and small chicks have difficulty eating from troughs and are naturally inclined to peck on the ground.

Young birds lack the gastroliths (commonly known as stomach stones or gizzard stones) and microbes necessary to digest and grind down fibre. From a young age they swallow small stones to help with digestion, and will also peck at the droppings of adult





birds to get the necessary fibre-digesting microbes. The bigger the bird, the bigger the stones that are swallowed (usually 50% to 75% of the size of the big toenail of the bird).

Adult birds are herbivores – a local study showed that, under intensive conditions, they spend approximately 10% of their time feeding, 20% pecking at soil or pasture, 50% resting and 2% drinking water. The remaining time is spent wandering around, to socialise and/or fight. Ostriches feed only during daytime and sit down in the evenings; they are inactive for the whole night.

## Slaughter Age & Feed Consumption

Slaughter age is a determining economic factor in production of ostriches under intensive conditions. Experimental information regarding the influence of slaughter age on feed consumption is set out in Table 3.3.

**Table 3.3** Cumulative feed consumption of ostriches between the ages of 6-16 months

Age (months)	Average intake per bird per day (kg)	Feed consumption per bird (kg/month)	Cumulative feed consumption (kg/bird)
6-7	1.1	33	33
7-8	1.4	42	75
8-9	2.2	66	141
9-10	2.9	87	228
10-11	2.9	87	315
11-12	2.9	87	402
12-13	2.9	87	489
13-14	2.9	87	576
14-15	2.8	84	660
15-16	2.7	81	741

## Slaughter Mass & End Products

The influence of slaughter mass on the yield of the most economically important end products is given in Table 3.4.

The yield of end products, such as the high price meat cuts, skins and feathers, increases with slaughter mass and age. Follicle size also increases with slaughter mass and age, while skin grading goes down. Market demand for specific features in end products and feed prices are the determining factors in decision-making with regard to ideal slaughter age. The ideal slaughter age for ostriches will thus vary according to these factors and will not always be the same.





**Table 3.4** Experimental information on end products (meat, leather and feathers) per slaughter bird at different slaughter weights

Slaughter mass (kg)	Meat			Leather			Feathers
	Carcass mass (kg)	Dressing percentage (%)	Total high-price meat cut yield per carcass (kg)	Skin surface (dm <sup>2</sup> )	Follicle size (mm)	Average grade (1-5)	
65	31	48	14.2	127	3.03	1.68	1.12
72	34	47	15.2	130	3.10	1.81	1.20
79	37	47	16.2	134	3.17	1.94	1.28
86	39	45	17.2	138	3.24	2.07	1.36
94	42	45	18.2	141	3.31	2.20	1.44
101	45	45	19.2	146	3.38	2.33	1.52
107	47	44	20.1	149	3.45	2.46	1.60
115	50	44	21.1	153	3.52	2.59	1.68
122	52	43	22.1	157	3.59	2.72	1.76



## Production Norms

The production rate of growing ostriches is dependent upon the nutritional composition of the feed. Table 3.5a shows practical production norms for ostriches under intensive feeding-paddock conditions and may be useful in feed-flow programmes. Table 3.5b provide average daily gains (ADG's) for ostriches fed according to norms calculated by the nutrition simulation model that was developed recently (Gous and Brand, 2008).

It is important to keep the effect of the energy concentration of the feed in mind, in particular of the daily feed intake and of the resulting feed conversion ratio, and the potential effect of this on the quantity of feed required per slaughter bird. The effect of slaughter age on the total quantity of feed required to reach that age is also important. In order to increase live weight from 90 to 100kg, an additional 30% of the total feed normally needed to reach 90kg is required. The total quantity of feed needed per slaughter bird to reach an age of 12 months (normally when the average skin and follicle size are acceptable to the market) is approximately 650kg per bird, whereas the total feed quantity needed per breeding pair (including the rest period) is approximately 1 500kg. At 25 chicks per breeding pair, the feed quantity per chick hatched amounts to approximately 60kg.

## Feed Processing

It is important to keep in mind that Lucerne hay in chick diets should be milled with a sieve of at least 4mm before it is used in pre-starter and starter diets, in order to prevent impaction of the digestive tract in young chicks. In cases where other diets than meal are given, the Lucerne and barley straw must be milled with a sieve of at least 6mm for chicks and at least 12mm for adult birds, again to prevent impaction in the digestive tract, as well as to improve feed conversion. Also keep in mind that pelleting of diets improves feed conversion by 10-15% during the growth and finishing phases.



**Table 3.5a** Experimental information on the annual quantity of feed required per slaughter bird and per breeding pair

Period/Interval	Age (months)	Intake* (g per bird per day)	Feed conversion* (kg feed per kg increase)	Annual feed intake (kg per bird)*	Cumulative feed intake (kg per bird)*
<b>Slaughter bird:</b>					
Pre-starter period	0-2	275	1.80	16	16
Starter period	2-4.5	1 100	2.75	84	100
Grower period	4.5-6.5	1 650	5.00	100	200
Finisher period	6.5-10.5	2 500	10.00	300	500
After finisher period	10.5-12.0	3 000	15.00	150	650
<b>Breeding birds:</b>					
		<b>Days</b>	<b>Intake per day (kg)**</b>	<b>Annual feed intake (kg)</b>	
Rest period		120	4.0	480	
Breeding period		245	4.0	980	
Total		-	-	1 460	

\*Based on feeding of pellets

\*\*Based on a 10:6 female-male ratio production system



**Table 3.5b** Growth rates and feed intake of ostriches during different feeding stages fed according to norms predicted by simulation models (Gous and Brand, 2008)

Growth Phase	Age (months)	ADG (g per bird per day)	Feed intake (g per bird per day)
Pre-starter	0-2.8	220	730
Starter	2.8-5.5	428	1116
Grower	5.5-8.1	401	1720
Finisher	8.1-11.5	236	2230

The following physical forms of feed for the different production stages of the ostrich are recommended:

**Table 3.6** Recommended basic form of ostrich feeds

Production stage	Processing (sieve gauge)
Pre-starter diet	Meal
Starter diet	Crumbs
Grower diet	Pellets (6mm-8mm)
Finisher diet	Pellets (6mm-8mm)
Maintenance diet	Pellets (6mm-8mm)
Breeder diet	Pellets (6mm-8mm)

## Summary

Many challenges remain regarding ostrich feeds and nutrition before the birds can be produced commercially as successfully as other farm animals.

The high mortality (30-40%) of chicks under commercial conditions can be ascribed mainly to diseases and other stress-related problems, although feeding, behavioural and nutritional imbalances also play a role. For example: recent studies indicated that high levels of dietary crude protein during the starter phase may increase chick mortalities drastically due to an overgrowth of *Clostridium perfringens* in the digestive tract of the bird (Brand, 2014).

The ostrich, a monogastric herbivore, has the capability to, apart from energy-rich concentrates; utilize fibre-rich ingredients that cannot be utilized to the same extent by other monogastric animals (e.g. fowls and pigs). The decision to use the correct quantities of, or combinations of, energy-rich concentrates or roughage in the feeding system ought to be based purely on economic principles, keeping in mind the needs of the bird

Factors to be taken into account in the design of optimal feeding strategies for growing ostriches are: the cost and availability of basic resources, the energy content, amino-acid composition





and digestibility of the nutrients in these resources, the quantity of feed that will be used, and the potential growth tempo and carcass composition. Simulation and optimisation models that are presently developed specifically for ostriches will in future be a valuable instrument to determine the most profitable feeding method and/or system (*Refer to Ch. 13: Economic Viability and financial management for more info.*).

The integration of production systems by using pastures may play an important role in the long-term sustainability of the ostrich industry. Scientific production data of ostriches on different types of pasture, as well as related aspects, for example supplemental feed and utilization of pastures, is still inadequate.

There are conflicts in production principles of current ostrich production systems as birds are kept for hides, meat as well as feathers (*Refer to Ch. 10: Slaughter-bird production for more info.*). The market demands that bird hides should be at least 12 months old, whereas for meat production it may be more economical to feed the bird only until its maximum growth potential is reached. This will result in birds ready for slaughter at too young an age to optimize profits from the sale of the hide. The simulation models can assist the producer in selecting the most economical feeding strategy to realise maximum profit – while still delivering the high quality end products that the market demands.

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## 4 | Breeding Of Ostriches

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### Introduction

Present schemes for the genetic evaluation of farm animals are based on the keeping of pedigree and production records. Information on environmental factors which influence the production of animals is also necessary. This information is processed with Best Linear Unbiased Prediction (BLUP) methods, in order to separate the influence of genetic and environmental factors in the data set. Using BLUP it is possible to estimate the genetic merit (or breeding worth) of every animal. The genetic merit of animals estimated according to this method, is expressed as a single figure per production trait, known as a breeding value. The breeding value is an estimate of the performance of the potential progeny of available replacement animals in the flock/herd.

Progress in breeding of most farm animals increased markedly over the last two decades. Currently formal schemes are available for the record keeping and genetic evaluation of dairy cows, beef cattle and small livestock. Considerable genetic progress has also been achieved in the relative performance of farm animals kept under intensive conditions, such as pigs and poultry. In contrast, there is no formal scheme available for record keeping and evaluation of ostriches. The potential for the selection for production traits in ostriches is explored in this chapter.

### Important Traits

Meat and skins are the most important sources of income for the ostrich farmer, representing approximately 90% of the total income from a slaughter bird. Feathers make up the remainder of the income. Good quality feathers are mostly harvested from adult breeding birds. Given the importance of meat and skins, the production of as many chicks as possible surviving to slaughter age is obviously of vital importance for a good monetary yield. Growth and feed conversion are also important for effective production of meat and skins of an acceptable size. Regarding the quality of skins, the absence of skin damage and the size and form of the nodules represented by the feather follicles are important.

### Basic Concepts

Explanation of a few basic concepts is necessary for a better understanding of breeding:





### Heritability ( $h^2$ ):

The concept of heritability gives an indication of the number of favourable alleles for a specific trait which are passed on from a particular animal to its potential progeny. Heritability is estimated by using the relationships between related individuals. To do this, specific information (records) of animals is used. Initially relatively simple relationships were used, such as the similarities between half-sisters and -brothers (i.e. animals with a common father). With advanced computer software presently available, all possible relationships are commonly used in a so-called animal model. The estimates are expressed as proportions (i.e. relative to 1), but can just as well be expressed as percentages. Selection pressure in a heritable trait will result in genetic gains in the next generation. The contribution of heritability estimates to genetic progress is somewhat arbitrary, because progress also depends on the inherent variation in any trait. According to the definition of Turner and Young, heritability estimates below 10% are classified as low. Estimates between 10 and 20% are moderate, and estimates above 20% are high. The coefficient of variation of any trait is generally accepted as an indication of the variation available for selection.

### Selection differential (S):

Most production traits in farm animals have a normal distribution, as is shown for a trait such as e.g. slaughter weight in ostriches (Figure 4.1). The selection differential is defined as the difference between the average performance of the selected individuals (B; to the right of the arrow indicating the cut-off point – above which individuals have been selected) and the average of all animals in the flock for which there are records (A). Thus in this particular instance the selection differential is  $99.7 - 94.0 = 5.7\text{kg}$ . Potential genetic gains are increased as the difference between selected animals and the average of the flock increased. The estimated genetic progress per generation (Ppg) can be derived, and is the product of the heritability and the selection differential, namely:

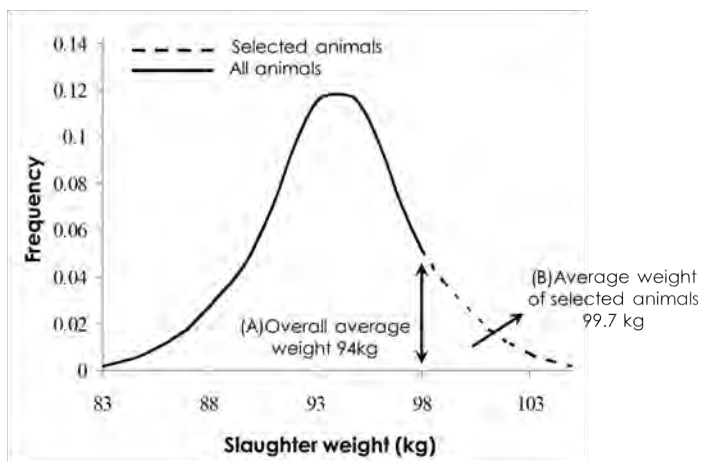
$$Ppg = h^2 * S$$

If a heritability of 0.4 is accepted for slaughter weight, the attainable genetic progress per generation would be:

$$Ppg = 0.4 * 5.7\text{kg} = 2.28\text{kg}$$







**Table 4.1** A Normal distribution for slaughter weight in ostriches, with an indication of the difference between the selected birds and all the birds (i.e. the selection differential)

#### Generation interval (T):

Genetic progress is also influenced by the generation interval of farm animals. The generation length or generation interval of animals is defined as the average age of the parents when their offspring are born. The estimated achievable genetic progress may also be expressed per annum by dividing the product of the heritability and the selection differential by the generation interval. For example:

$$V_{pj} = \frac{h^2 * S}{T}$$

With a generation length of 6 years Ppy could be expressed as:

$$V_{pj} = \frac{0.4 * 5.7 \text{ kg}}{6 \text{ years}} = 0.8 \text{ kg / year}$$

From this it is clear that breeding progress could be achieved if

- a trait is heritable and variable,
- a good selection differential could be maintained, and
- the generation interval is as short as possible.

These aspects must be kept in mind in the following discussion.

#### Environmental factors

Production traits in all farm animals are influenced by common external factors. In ostriches, production years and production seasons are typical examples of external environmental influences – due to climate, management, feeding, health, etc. Normally such factors are unpredictable and not repeatable, but their influence should still be considered to obtain accurate estimates of genetic parameters (heredities and genetic correlations). Failure to do





so will increase the non-genetic part of variation accordingly, and lead to a reduced heritability. In other animals, sex is often an important source of non-genetic variation, but in ostriches differences between the sexes are less pronounced. Females are however inclined to deposit more subcutaneous and internal fat than males, whereas males usually have thicker skins than females. The weight of ostrich chicks is influenced by their age; weight data should be adjusted for age when chicks from different hatching groups are kept in the same management group. Traits such as nodule size and nodule form are also influenced by age; adequate scores for these traits are mostly achieved only at 12+ months. This places an important limitation on the age at which ostriches should be slaughtered for the production of leather. The age of the female has an important influence on the weight of eggs and day-old chicks, but is less important for the weights of older chicks.

Reproduction of ostrich females is nevertheless dependent on their age. Two-year-old females have lower egg production, possibly because not all of them reach physiological maturity at the same age. If, for instance, selection is based on egg production of individual females in a flock and age is not considered, two-year-old females stand a good chance of being culled. Therefore, age should be taken into account in the selection of females based on their own reproduction performance. Conversely, females older than 10 years could still be laying quite well. The hatchability of their eggs however, decreases, because of an increase in shell-deaths, so that they perform less well for chick production. It is advisable to replace such females with selected younger birds. The retention of large numbers of old birds in the flock also leads to longer generation length which, consequently, will impede genetic progress.

### **Heritability of traits**

Heritability of important reproduction traits such as egg- and chick- production could be classed as moderate or high, while these traits also display marked variation (Table 4.1). On the other hand, the heritability of hatchability is low. The hatching performance of the female is also influenced by the male to which she is mated. If traits like egg- and chick- weight are seen as traits of the female (i.e. the average of all the eggs laid in a season), these traits are highly heritable. In contrast to reproduction, these are traits with a relatively low variation between females. Loss of moisture during incubation (which is related to shell-deaths) also shows genetic variation. From these facts it is clear that genetic progress is achievable in all the reproduction traits. Survival of chicks also shows significant genetic variation, although most heritability estimates are in the low category.





**Table 4.1** Measure of variation and heritability of economically important production traits in ostriches

Trait	Variation <sup>A</sup>	Heritability <sup>B</sup>
<b>Reproduction:</b>		
Egg production	Very high	Moderate to high
Chick production	Very high	Moderate to high
Hatchability	Very high	Low
Average egg weight	Low	Very high
Average chick weight	Low	Very high
Chick survival	High	Low
<b>Body weight:</b>		
3 Months	High	Low
6 Months	Moderate to high	Moderate to high
10 Months	Moderate	Moderate to high
Slaughter weight	Moderate	Moderate to high
Adult weight	Low to moderate	High
<b>Skin traits:</b>		
Skin area	Low	Moderate to high
Crown width	Low	High
Nodule size	Moderate to high	Moderate to high
Nodule shape	High	Moderate to high
Incidence of pinpricks	High	High
Incidence of pit marks	High	Moderate
<b>Feather traits:</b>		
Weight of feather types	Moderate to high	Moderate to high
Total feather weight	Moderate	High

<sup>A</sup> Low - < 10%; Moderate - 10 to 25%; High - 25 to 50%; Very high - > 50%

<sup>B</sup> Very low - < 5%; Low - 5 to 10%; Moderate - 10 to 20%; High - 20 to 50%; Very high - >50%

With regard to body weight and growth of ostrich chicks, it has already been established that, at a young age (approximately 3 months), there is low levels of genetic variation available for selection (Table 4.1). In older chicks (6+ months), the heritability of body weight is however, moderate to high, with more variation. Thus it is possible to breed ostriches to grow more rapidly, to be ready for slaughter at a younger age. However, the relationship between age and nodule shape and size influences decision-making in production systems where skins contribute considerably to production income, as is the case in South Africa. Heritability of skin size is moderate to high, but it shows less variation than for instance slaughter weight. Skin traits relating to quality (nodule shape, nodule size, crown width and defects such as pinpricks and





pit marks) are also moderately to highly heritable, with an adequate measure of variation. This suggests that skin traits related to quantity (i.e. size) as well as quality (nodule traits, crown width, etc.) will respond to selection.

Feather yield from different parts of the body shows moderate to high levels of variation, linked to moderate to high heritability estimates. Earlier research showed that the number of feather quills on the wings of ostriches is moderately heritable. Results suggest that it is possible to select for feather weight with a great measure of certainty.

### Genetic correlations

At the genetic level the correlation between egg- and chick-production is so high that it can be regarded as the same trait in practice (Table 4.2). Both traits are favourably correlated (positive in this case) with hatchability (i.e. females with a high egg production should also have high hatchability). Genetic correlations of the quantitative reproduction traits (egg- and chick- production) with the reproduction traits related to quality (egg- and chick- weight) are low and mostly favourable. Selection for better egg production should therefore not adversely affect egg weight, as is sometimes the case with poultry. The genetic correlations of body weight with reproductive traits are low (Table 4.2); it is envisaged that both traits can be improved within a flock with breeding. This is in contrast to poultry, where separate lines for egg production and slaughter birds are maintained.

**Table 4.2** Order of magnitude and direction of genetic correlations among economically important traits in ostriches

Trait	Correlated trait	Genetic correlation <sup>A</sup>
<b>Reproductive traits:</b>		
Egg production	Chick production	Very high positive
	Hatchability	Very high positive
	Average egg weight	Low to moderately positive
	Average chick weight	Low and variable
	Adult body weight*	Low positive
Chick production	Hatchability	Very high positive
	Average egg weight	Low to moderately positive
	Average chick weight	Low positive
	Adult body weight*	Low positive
Hatchability	Average egg weight	Moderately positive





Trait	Correlated trait	Genetic correlation <sup>A</sup>
Average egg weight	Average chick weight	Moderately positive
	Adult body weight*	Low negative
	Average chick weight	Very high positive

<sup>A</sup> Very low - < 10%; Low - 10 to 20%; Moderate - 20 to 40%; High - 40 to 60%; Very high - > 60%

<sup>B</sup> Very low - < 5%; Low - 5 to 10%; Moderate - 10 to 20%; High - 20 to 50%; Very high - >50%

Genetic correlations among body weights taken at different ages are very high (Table 4.3). Thus, at the genetic level, body weight at 6 months could be regarded as virtually the same trait as slaughter weight. The same observation holds for skin size which also correlates very high with slaughter weight at the genetic level. This is advantageous, seeing that skin size is only measurable on slaughtered birds, and thus it can only be selected for indirectly. Skin traits related to quality (e.g. nodule size, nodule shape and crown width) correlate favourably with skin size and slaughter weight, and thus should also react to indirect selection for body weight. The only quality traits not correlated with skin size are the incidence of pinprick and pit-mark defects. Nodule traits are generally positively (i.e. unfavourably) correlated with these defects, but the correlations are not very high. An exception is the moderately high unfavourable correlation of 0.55 between nodule size and the occurrence of pit marks. The present correlation is however based on relatively few data, and thus not very accurate. Further analyses are envisaged to either confirm or reject it.

Most ostrich meat is being sold as muscle cuts. Genetic correlations among slaughter weight, carcass weight and muscle cuts were generally favourable, suggesting that indirect selection for muscle weights by targeting live weight and/or slaughter weight should be feasible.

Recently it has been shown that genetic progress in economically important slaughter traits is feasible at all levels of industry. Even if only basic recordings are done in colony mating systems where no pedigree information is available, it should still be feasible to make progress with mass selection. This is made possible by genetic variation in all traits of economic importance and generally favourable genetic correlations among traits.





**Table 4.3** Order of magnitude and direction of genetic correlations among body weight and slaughter- and skin traits in ostriches

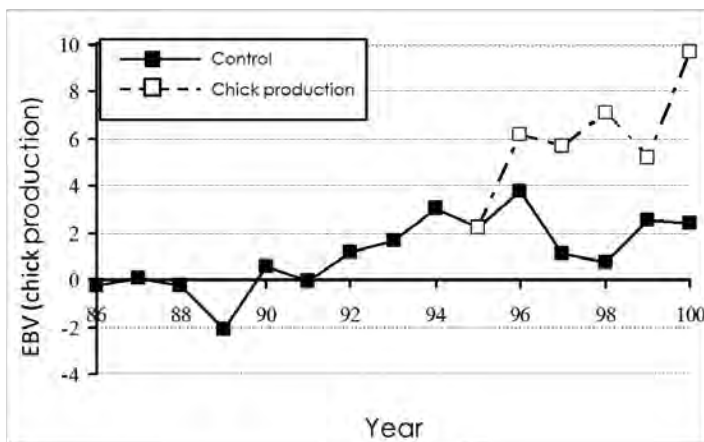
Trait	Correlated trait	Genetic correlation <sup>A</sup>
<b>Body weight:</b>		
6 Months	10 Months	Very high positive
	Slaughter weight	Very high positive
10 Months	Slaughter weight	Very high positive
<b>Slaughter and skin traits:</b>		
Slaughter weight	Skin area	Very high positive
	Crown width	Very high positive
	Nodule size	Very high positive
	Nodule shape	High positive
	Incidence of pinpricks	Very low negative
	Incidence of pit marks	Moderately positive
Skin area	Crown width	Very high positive
	Nodule size	Very high positive
	Nodule shape	High positive
	Incidence of pinpricks	Low negative
	Incidence of pit marks	Moderately positive
Crown width	Nodule size	Moderately positive
	Nodule shape	Very low positive
	Incidence of pinpricks	Very low positive
Nodule size	Nodule shape	Very high positive
	Incidence of pinpricks	Low positive
	Incidence of pit marks	High positive
Nodule shape	Incidence of pinpricks	Low positive
	Incidence of pit marks	Moderately positive
Incidence of pinpricks	Incidence of pit marks	Moderately negative

<sup>A</sup> Very low – < 10%; Low – 10 to 20%; Moderate– 20 to 40%; High – 40 to 60%; Very high – > 60%



## Achieved Progress

The above information suggests that selection progress is achievable in all the important production traits. The progress that could be achieved has, however, not been demonstrated in practice. Nevertheless, in the last few years progress achieved by selection for chick production could be demonstrated. Selection of replacement birds is based on the performance of the dam of the particular replacement bird in the season that it was hatched. The realised progress is shown in Figure 4.2.



**Figure 4.2** Annual average breeding values (EBV) for chick production in two selection lines on the Oudtshoorn Research Farm. Active selection for chick production has been done in the Chick production line, while no selection was applied in the Control line.

The resource flock on the Oudtshoorn Research Farm had been subjected to selection for chick production since 1990, as can be seen from Figure 4.2. The realised progress may perhaps be attributed to random genetic drift instead of a response to selection. Therefore, in 1996 a line was established in which no selection for chick production was done (the Control line). The subsequent response to selection for chick production in the Chick Production line is very clear in Figure 4.2. This progress amounted to approximately 3% per year, which compares favourably with progress in production traits in other farm animals. On the other hand, the average annual breeding values of the Control line stabilized at lower levels. The effect of selection is very clear in the average genetic merit (as reflected in the breeding values) of the Chick Production line, which genetically improved to more than 10 chicks per year in the replacement birds which were hatched



in 2005 and 2006. In contrast, the average genetic merit of the Control line over this period amounted to approximately 2 chicks per year. With an average chick production of 22 chicks per season, the advantage of genetic progress of the above order of magnitude is obvious. A similar measure of genetic progress is probably also possible in other economically important traits in ostriches.

## Structures In The Ostrich Breeding Industry

From the preceding discussion it is clear that noteworthy breeding progress in ostriches is feasible. The production systems presently followed at the majority of ostrich production units are however not aspiring to achieve breeding progress. In order to achieve this progress, considerable changes would have to be made to commercial breeding flocks. The following aspects need attention:

- Commercial ostrich production is based largely on flocks that are mated in a male to female ratio of approximately 6:10 in large paddocks. The social behaviour of ostriches renders it impossible to determine parentage (and thus pedigree) under these conditions. It is also impossible to determine the egg- or chick- production of individual females. Indirect methods to determine egg production (such as for example ultrasonic scanning) have been investigated, but in the long run these methods could not forecast egg production accurately.
- Under such circumstances it is nevertheless possible to achieve progress in a trait such as chick weight through mass selection (i.e. a few measurements on many available birds without pedigree and performance records apart from body weight), by selecting the heaviest individuals (with weights adjusted for age) as parents of the next generation. However, it will be impossible to achieve the same measure of progress as could have been achieved with exhaustive information. Because pedigree information is lacking, relationships among individuals cannot in this instance contribute to the process of genetic evaluation more accurate.
- Genetic markers could be applied successfully in the flock situation to acquire pedigrees, and also to obtain individual egg production records of females. Preliminary results for egg production obtained from one such colony compare well with those from breeding pairs. However, the cost of DNA analyses presently prohibits the wider practical application of this technique.
- The problem with pedigrees could be resolved by putting males and females in small paddocks as pairs. However, the capital outlay for the establishment of the infrastructure to enable such a breeding system is such that it is not widely practised. Furthermore, males and females should be







exchanged to form new pairs and also between paddocks to ensure that these effects (i.e. male, female and paddock) do not become totally confounded. The confounding of effects impedes modelling in genetic analyses

The limitations mentioned above, hamper the large-scale genetic evaluation of ostrich flocks of the majority of commercial producers. Looking to alternative strategies, the following possibilities may be considered:

- The establishment of a relatively small, centralised breeding industry for ostriches, such as is the case with poultry. Data obtained from breeding operations that are already geared to supply breeding values to the industry (in other words those that have already done the capital outlay for individual paddocks and/or DNA analyses, etc.) could be used to estimate breeding values. Genetic material from these systems could then, according to specific requirements, be provided to the broader commercial industry.
- Under such circumstances the maximum levels of genetic merit should be supplied to the commercial industry. A breeding plan, based on the economic values of the various traits, is thus required. The breeding plan should make provision for indices which will provide various options to commercial producers for their breeding policy, for example extra emphasis on meat-, skin- or reproduction traits.

## Crossbreeding

Crossbreeding of divergent types in farm animals is often seen as a method to improve general productivity (and with it profitability). Advantages in crossbreeding that could be utilized are hybrid vigour (heterosis), as well as size differences between male and female lineages (also known as sexual dimorphism). Hybrid vigour is defined as the advantage of the crossbred genotype over the average of the pure breeds from which it was derived (also known as mid-parent value). This is particularly applicable to traits that are of relatively low heritability, such as survival and early growth in ostriches. Preliminary results did not indicate high levels of hybrid vigour between types within the 'South African Black' (SAB) gene pool (so-called feather birds, in contrast to a more commercial type). Subsequent research on SAB ostriches and the more distantly related 'Zimbabwean Blue (ZB)' genotype suggests considerable differences between the pure genotypes in 14-months body weight and survival to 30 days (Table 4.4). With the reciprocal cross between the genotypes it was also possible to estimate hybrid vigour, which amounted to 6.7% for both traits.





**Table 4.4** Average performance of the 'South African Black (SAB)', 'Zimbabwean Blue (ZB)', SAB x ZB and ZB x SAB genotypes for 14-months weight and chick survival to 30 days

Pure or cross type	Genotype	Weight at 14 months(kg)		Survival to 30 days (%)	
		Average	Average	Average	Average
Pure	SAB	89.6	94.0	72.6	67.4
	ZB	98.3		62.2	
Cross	SAB x ZB	100.8	100.2	66.4	71.9
	ZB x SAB	99.6		77.4	
Hybrid vigour (%)			6.7		6.7

Furthermore, it is known that the reproduction of the SAB type is considerably better than in the ZB type, with the egg- and chick-production of the former genotype double that of the ZB. It remains to be determined to what extent hybrid strength for reproduction is present in crossbred descendents. Based on experience with other farm animals however, the chances are good that hybrid vigour will be achieved in fitness traits like reproduction. The extent to which hybrid vigour could contribute to better reproduction in crossbred descendents of the SAB and ZB types, is still being researched. The possible contribution of a third genotype (the 'Kenyan Redneck') to commercial ostrich production is also still under investigation.

The advantage of sexual dimorphism has a bearing on breeds in which the males are relatively heavy, which can be used on considerably lighter females (thus with lower maintenance requirements). The progeny from such a cross thus grows better than the pure progeny from the female lineage, whereas the feeding costs for the maintenance of female animals are less. Because the male:female ratio in ostriches is so narrow (in other words relatively many males per female are required), this principle will not hold the same advantages as for other farm animals with a wider male to female ratio. However, a comparison between the SAB and ZB genotypes (Table 4.4) indicates an extent of sexual dimorphism favouring the ZB type. Terminal cross-breeding with the rapid-growing ZB genotype as sire breed on the more reproductive SAB as dam breed could thus theoretically be advantageous. Research on the application of cross-breeding for the utilization of hybrid vigour and sexual dimorphism in commercial ostrich production systems continues.

## Conclusions And Future Developments

From the preceding discussions it is evident that ostrich breeding could be placed on a sound scientific base. There are however a few unfavourable correlations among economically





important traits, which could handicap a potential breeding plan for ostriches. Developmental work should therefore still continue to design a structured breeding plan. Important information is also still lacking, and further research is needed before such a breeding plan could be finalized. The industry should reflect seriously on the composition of a feasible and sustainable structure for maximum genetic progress. The possible utilization of hybrid vigour in commercial flocks also warrants further attention.

## Acknowledgements

The information in this section is based largely on the research carried out by students and colleagues in the breeding programme over many years. The compilation of information would have been impossible without these sources. The genetic resources, on which all the studies are based, have been maintained for many years by the Klein Karoo Cooperation. My sincere thanks also to everyone involved in the management and maintenance of the flock.

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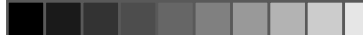
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## 5 | Reproductive Management Of Breeding Birds For Optimal Reproduction Efficiency

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Commercial ostrich farming systems are characterized by a large degree of variation in the cost-efficient production of slaughter birds (*Refer to Ch. 10: Slaughter-bird production and Ch. 13: Economic viability and financial management for more info*), with the latter being determined by the reproductive efficiency of breeding birds. Factors contributing to this observed variation include unsynchronized and irregular egg production cycles, a long interval from when the breeding birds are joined for breeding till the first egg is produced, age at which birds can be considered reproductively mature (i.e. enter a breeding flock), lack of selection for reproduction, and non-conducive breeding environments. Cost-efficient production is also hampered by breeding ostriches taking a natural break in production around the end of September, resuming production 3-4 weeks later.

In South Africa, approximately 70-80% of commercially farmed ostriches are maintained in breeding flocks, with flock sizes ranging from 50-100 birds. This hinders the identification of non-producing or poor producing individuals. The natural behaviour of ostriches during the breeding and non-breeding season impedes the identification of non-producing individuals, due to the fact that females lay in communal nests, and breeding males in flock mating systems tend to keep a harem of on average 5-8 females.

### General Information On Reproductivity In Ostriches

#### Seasonality of reproduction

Ostriches have developed a reproduction strategy that will ensure the survival of their progeny during the time of the year when food is abundant, and the environment will favour the survival of their offspring. For example, reproduction in Kenyan Redneck ostriches that occur on or close to the equator is influenced mainly by rainfall and availability of food, whereas reproduction in South African Black ostriches, which occur much further south in Africa, is mainly influenced by photoperiod. This should be considered in breeding bird management programs; joining birds for breeding during a time of the year when they are insensitive to the stimulating effect of photoperiod may result in poor reproduction.





## Physiology of the male and female reproductive systems

Males are responsible for the production of healthy, viable sperm and the defence of the breeding camp. The copulation organ of the male is known as a phallus (similar to a penis of mammals), and lies folded inside the proctodeum compartment of the cloaca. The phallus is characterized by a dorsal groove, which guides the sperm during transport after ejaculation, to the vagina of the female, where it is then deposited. The average phallus length differs between older and younger males (40cm vs. 25cm, respectively). The time of year also influences the size of the phallus, during the breeding season the phallus increases in size as a result of the influence of the reproductive hormones. During mating the male will service the female from just left of the midline – this position is mainly due to the fact that the phallus curves to the left when it is out of the proctodeum.

The female ostrich has a single ovary, situated on the left side of the body in the body cavity. The ovary of the female assumes the appearance of a flat grey “disc” during the non-breeding season, with a lack of follicular activity on the ovary due to the low levels of circulating reproductive hormones such as follicle-stimulating hormone and oestrogen. During the breeding season, the ovary will look like a “bunch of grapes”, due to a follicular hierarchy present on the ovary. Ostrich females vary considerably in terms of the number of eggs they can produce. A female’s reproductive ability is influenced by nutrition, behaviour, management and the presence of the male. Under natural conditions a female could lay 8-15 eggs per clutch in a nest. The clutch size does, however, not reflect her true production ability. In nature and in flock-mating systems, it is also typical for more than one hen to lay in a nest and a single hen to lay in more than one nest. Such a communal nesting system complicates the determination of the individual reproductive performance and contribution of each male and female.

## Behaviour Of Breeding Ostriches

Adult breeding ostriches display characteristic behaviour during the breeding season. Broody behaviour displayed by the female demonstrates her readiness to mate. This is characterized by the female walking with her wings stretched out alongside her body and shaking them gently, keeping her head close to the ground and pecking at the soil aimlessly. ‘Clucking’ is observed when a female indicates her solicitation and receptivity to a male.

The breeding male is the more aggressive of the two sexes, with typical territorial behaviour displayed during the breeding season. The change in colour of its beak and shins from pale pink to deep red is interpreted by ostrich farmers as a sign of readiness for the coming breeding season – breeding birds are generally put into breeding camps shortly after this change in





the colour of the shins. The reproductive behavioural display of males (or 'kantling' display) is characterized by the male sitting on his hocks, and swaying from side to side, with outstretched wings alternately touching the ground. During the display the neck is usually pulled backwards, with the head positioned near the back of the bird.

The length and frequency of mating sessions may differ among males, and even for a single male. Mating will occur more often in spring months (September-November), while peak egg production occurs in late winter-early spring (August-September). A mating session can last 30 to 90 seconds, with the male mating several times a day with any one female. A male mounts a female from behind, and the condition of the feathers on her left back side is often used as an indication of mating.

The male will search for a suitable place to create a nest for the female, normally after the first mating has occurred. The hen usually lays her egg in the early morning (before 8am) and late afternoon (after 4pm). Both cock and hen sometimes display clucking/broody behaviour next to a nest; it is usually associated with the presence of eggs or the male's solicitation towards the female to produce an egg.

## **Factors Affecting Reproduction Efficacy Of Breeding Birds**

### **Environmental factors**

#### ***Mating practices and systems***

It is important to understand the reproductive and overall behaviour of breeding ostriches to ensure that they reproduce as optimally as possible. Ostriches have very specific behavioural requirements that need to be accommodated in breeding systems. A good example is where breeding birds are kept in a flock system for one year, and moved to smaller breeding camps in the next breeding season. Such a change of breeding environment, and probably also breeding partner, can have a very adverse effect on the reproduction efficiency of both males and females. Breeding females appear to be more sensitive to such changes than males.

Even to transfer a breeding combination, i.e. any pair or unit to another camp, may have a substantial effect on reproduction. Egg production can decline by as much as 50% in the first season in the new camp, but will recover if the specific breeding combination is returned to the same camp the following year. Egg production in adult breeding ostriches is highly repeatable, i.e. if one has an indication of the egg production potential of a female under optimal conditions, this will provide the producer with an estimate on the number of eggs a female will produce in following years.







### **Egg collection strategies**

The egg collection strategy is determined by the type of mating system. With intensive system breeding combinations (pairs, trios and quads), eggs are collected daily and incubated artificially. This strategy minimizes the environmental influences on the quality of the egg are minimized. In extensive systems, eggs are collected approximately every second day, in which case the longer exposure to the elements could affect the relative sterility and hatchability of the eggs (*Refer to Ch. 7: Natural and artificial hatching of ostrich eggs for more info.*).

### **Environment**

The environment, in which the breeding camps are situated, can have a considerable influence on the production of breeding birds. For example, when breeding camps are located close to public roads or where footpaths go through camps, the activities could disrupt the natural breeding behaviour, with a consequential decline in egg production. Camps located on the periphery of a breeding system, are more prone to predator activity. Baboons and black-backed jackals are two examples of predators that could disrupt the reproduction-related activities of breeding birds, and could therefore have an adverse effect on the reproduction efficacy of the birds.

### **Stress**

Any form of stress, i.e. in terms of management, nutrition, temperature, behaviour and diseases, can have a substantial effect on the reproductive efficiency of ostriches. It is important to manage breeding conditions at all times in such a way that the influence of any potential stressor is kept to the minimum.

### **Animal-related factors**

#### **Puberty and sexual maturity**

It is important to distinguish between puberty and sexual maturity in ostriches. Puberty can be defined as the age at which sperm are present in an ejaculate (in males), and follicles on the ovary (in females) become visible. Puberty is however not synonymous with sexual maturity. As in the case of other domesticated farm animal species, the onset of puberty is affected by body weight. The sooner a male or female reaches a certain body weight, the sooner they will go into puberty.

Sexual maturity in breeding birds can be defined as the age when the reproductive systems of both genders are fully developed and functional, and the hormonal levels are high enough to initiate, support and maintain reproduction-related activities AND when the functioning of the reproductive system is synchronized with that of the endocrine or hormonal system, in order to ensure successful and optimal reproduction.

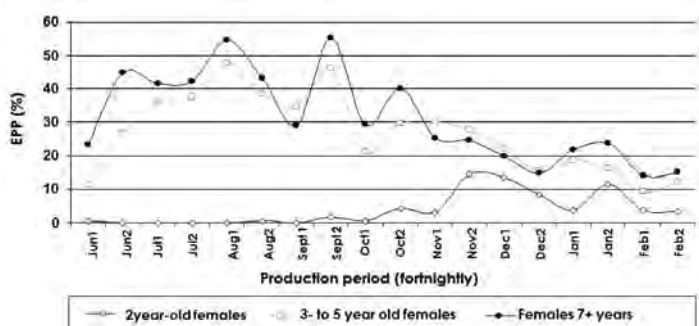




## Age

The age at which breeding ostriches reach sexual maturity differs among the various ostrich breeds. South African Black ostrich males reach sexual maturity at an age of approximately 3 years, whereas males of the Zimbabwean Blue and Kenyan Redneck breeds only reach sexual maturity at approximately 4 years of age. South African Black females are sexually mature at 3 years, even though they can start producing eggs at as early as 18 months of age. Zimbabwean Blue and Kenyan Redneck females reach sexual maturity a year later than SA Black females. With improved feeding and selection it is possible to select for early sexual maturity in males and females.

Figure 5.1 shows the influence of age on the egg production performance (EPP) of females. Two-year-old females go into production only around November, the time when the reproductive system start to function in synchrony with the endocrine (hormonal) system.



**Figure 5.1** Influence of female on the egg production performance of ostrich females, and the age at which females can be considered reproductively mature (i.e. have an ability to successfully produce eggs for an entire reproductive season).

### Recommendations:

- It is common practice to join SA Black males and females for their first breeding season at the ages of two and three years, respectively. The breeding birds are thus joined for breeding before they are considered as sexually mature, and are thus bound to perform poorly during their first breeding season.
- Apart from not having reached sexual maturity, they also have to get used to a new mate, new breeding camp and new management programme.

### Libido (Sex drive)

Libido in breeding ostriches is characterized by normal reproductive behaviour repertoires, among which are territorial behaviour





and the related aggression in males, and clucky behaviour and broodiness in females. Libido has been demonstrated to be higher in spring months (September to November), but can also be affected by, among other things, nutrition, management and/or diseases.

*Recommendations:*

- The absence of libido is an indication that one or more of the above mentioned factors have a negative or inhibiting effect on the reproductive efficiency of breeding birds. Each of these factors should thus be investigated to identify and eliminate the possible cause. Regular observations should be carried out throughout the breeding season in order to identify and address any negative influences on the reproduction of the birds timeously. For instance, disturbance in the environment, incompatibility between mates and/or competition over mates in the case of males maintained in small camps can negatively affect male libido.

**Fertility**

Fertility of males could be influenced by genetics, behavioural, environmental or physiological factors. The fertility of individual males can be determined by accurate record keeping and semen evaluation. This is going to become increasingly important in the future, should a producer want to incorporate or make use of artificial insemination as a reproductive tool, good quality ejaculates are crucial to ensure the success of the procedure.

*Recommendations:*

- In the case of breeding pairs, trios or quads, keeping of accurate egg production and breeding records will be a good reflection of the fertility of the male. Examination of the egg fertilization status by breaking-up the egg could also help having a more accurate indication of fertility rates.
- In the case of flock mating, it is recommended to examine the fertility of males through standard semen evaluation, particularly in cases where males have pale shins or have a frazzled appearance. Semen evaluation will provide an indication of the health and viability of the male's sperm. It can however not be used exclusively to determine fertility, because the reproductive success of the breeding combination can be influenced by various factors. There is also the possibility of a physiological problem or defect in the female.

**Nutrition**

Breeding ostriches should receive fully balanced rations during both the breeding and the rest season. The feeding of an unbalanced diet during these periods will have a negative effect on the reproduction potential and efficiency of the bird. Any imbalance in terms of nutrients will result in the production of low quality eggs and chicks. An imbalance in one of the nutrients can affect the bird's ability to utilize the full ration efficiently.





The rations fed during the two periods differ mainly in protein, energy, vitamin and mineral levels. The composition of the ration given to the male and particularly the female during the rest period is very important, as the birds replenish their body reserves to prepare for the following production phase. The female in particular subjected to serious physiological stress during the breeding season. Breeding rations should therefore contain high enough levels of these minerals to prevent a decline in reproduction (*Refer to Ch. 3: Ostrich nutrition guidelines for more info.*).

### **Genetics**

Reproductive traits have low heritability, which makes it difficult to rapidly achieve genetic progress in this trait. In contrast to a trait like e.g. mass, it is much more difficult to select for egg production and the consequent chick production. The long generation interval in ostriches also hampers the rate of genetic progress (*Refer to Ch. 4: Breeding of Ostriches for more info.*).

### **Flock size**

The guidelines on the utilization of pasture by breeding birds in South Africa prescribe a minimum area of 10 ha per breeding ostrich for an 8-month period. Research showed that breeding ostriches can be kept at higher densities and still have acceptable production rates. The number of birds in a breeding herd will be determined by both the camp size and the condition of the vegetation. However, it is important to remember that there is an interaction between flock size and the various reproduction parameters. When a flock consists of too many birds per flock (e.g. 230 birds per hectare), total and average egg production, fertility and hatchability will decline.

### **Male: female ratio**

The male: female ratio to be used will be determined by the type of mating system and/or the camp size. Because ostriches use a promiscuous system in natural conditions (i.e both males and females have multiple partners), it is important to use a male (M): female (F) ratio higher than 1M: 1F. Flock mating is the mating system closest to the natural scenario, but also the most inefficient in terms of genetic progress because superior males can only mate with a few females in one season. In addition, extra feeding costs are associated with maintaining those surplus males.

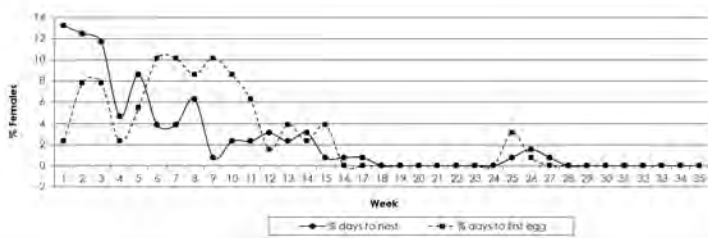




## Management Practices To Optimize Production

### Synchronization of cycles

The common practice in South Africa is to join breeding birds at the end of May, when the number of daylight hours is too short to effectively initiate sperm production and follicular development. The early joining of breeding birds result in an asynchrony in reproductive activities i.e. certain males and females are more receptive/sensitive to the change in daylight length and thus are synchronized sooner. The effect on the initiation of egg production is a slow increase in the number of females that come into lay, with initially only a small number of females that will lay eggs. As the season progresses, more breeding birds will come into production, and by the end of July just about the entire flock should be in production. Figure 5.2 shows the influence of synchronization of the reproductive cycles of females.



**Figure 5.2** The influence of synchronization of breeding ostriches on the number of days from joining of breeding birds till the making of the nest, and the production of the first egg.

#### Recommendations:

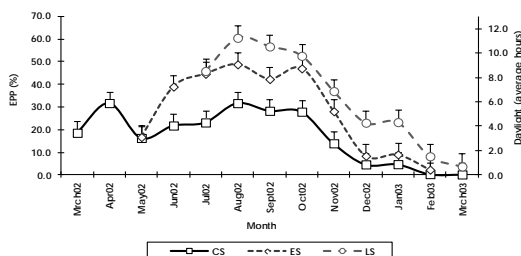
- By synchronizing the reproductive cycles on an individual and breeding pair basis, the producer can forecast the flock's reproduction pattern better and thus improve the commercial outcome. Early-laying females and males actively engaged in reproductive activities early in a season are usually the individuals in the flock that are also the better producers.

### Breeding rest period and a mid-season breeding rest period

#### Pre-breeding season rest period

Breeding ostriches experience high levels of physiological stress during the breeding season. It is therefore important to allow them a rest period to replenish their body reserves for the new breeding season. To keep breeding birds in production all year, will result in poorer production throughout the breeding season. Figure 3 shows the influence of a rest period before the start of a breeding season on the seasonal egg production of breeding birds, as compared to egg production in birds that were not allowed to recuperate their reserves during a pre-season breeding rest period.





**Figure 5.3** The influence of a pre-breeding season rest period on the seasonal egg production of breeding ostriches.

### Assisted reproduction techniques

Artificial insemination (AI), an assisted reproduction technique that is used in cattle and sheep production systems, has over the last few years received considerable attention in the ostrich industry. The development of a viable protocol for AI could facilitate genetic progress as the semen of one superior male could be used to inseminate several females. The latest achievements in this regard include:

1. the development of a semen collection method that involves either a teaser female or a dummy female (similar to the artificial vagina semen collection method);
2. the development of a resource flock of females laying eggs without the presence of a male; and
3. the development of a stress free insemination method, using the voluntarily crouching behaviour (i.e. female sits in response to a human presence). Hence the artificial insemination of females could be performed in the female's camp and only requires two people. Because these methods rely on the complete collaboration of the birds, both males and females have to be carefully chosen based on their responses to humans (i.e. lack of fear; lack of aggression; display of sexual behaviour). Imprinting of day-old chicks on humans (i.e. birds developing a bond with human) could be a powerful tool not only to train birds to those methods, but also to improve human-animal relationship and animal welfare. This can be achieved by using positive interactions such as regular and gentle contact. It was demonstrated that such interactions improved chick survival and growth, as well as the docility of birds when they reach the juvenile stage

To ensure the use of viable sperm for AI purposes, a suitable diluent and cryopreservation protocol needs to be developed that will aid in the preservation of semen samples for AI purposes.





Recently, the first chicks were hatched following artificial insemination after short-term storage of semen but research is currently underway at the Oudtshoorn Research Farm to determine the optimum semen handling and storage, as well as the optimum insemination dose and frequency of inseminations. Ultimately, establishing all-female flocks could have a positive influence on feeding costs as well as the preservation of veld resources by decreasing the number of males in a flock mating situation. However, the potential limitation of induced breeding in females (i.e. the male need to be in close proximity) need to be managed and/or overcome to enable the establishment of all-female flocks (For more info on this topic, contact Dr Maud Bonato ([mbonato@sun.ac.za](mailto:mbonato@sun.ac.za))).





## 6 | Management And Care Of Breeding Birds

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### Introduction

The breeding or reproduction season of ostriches in the Little Karoo begins during May/June and usually lasts until the end of January the following year. Breeding usually continues for about eight months, but may last up to ten months. Egg production normally peaks in August/September, followed by a natural, short rest period the next month. Thereafter, production increases again gradually, with a second peak in December, followed by a steep decline towards the end of January, when breeding birds are separated for a rest period (Refer to Ch. 5: Reproductive management of breeding birds for optimal reproduction efficiency for more info.).

### Rest Period

It is important that breeding birds are not disturbed during the breeding season, as it may lead to a break in production. For this reason, the handling of breeding birds is limited to the rest period from February to April/May.

#### Internal and external parasite control

There are a few different types of parasites that are of economic importance found in/on ostriches: wire worms and tape worms which are internal, and shaft mites, feather lice and ticks, which are external. Breeding birds need to be dosed against both internal and external parasites. A variety of registered products are on the market to treat these parasites. It is normal management practice to dose for one of the internal parasites types (e.g. tape worms) when taking the birds out of the breeding paddocks at the end of the breeding season and dose for the other type of internal parasite (e.g. wire worms) upon putting the breeders back into the paddocks after the resting period. There are also combination-products on the market for treating both types of internal parasites at the same time. Pour-on, spraying and injectable products are available for external parasites (shaft mites, feather lice and ticks) (Refer to Ch. 11: Health management for more info.).

#### Spraying and plucking of feathers

After a long breeding season the feathers will be quite dirty and tatty, and therefore it is recommended that birds be sprayed with a registered product to 'wash' the feathers before plucking. This way the bird can be rid of all the shaft mites, feather lice and ticks







that settled onto the feathers during the breeding season. It is sound management practice to spray the breeder birds again with a dip just before putting them in the breeding paddocks. This will improve the chances of harvesting better quality feathers after the breeding season (*Refer to Ch. 10: Slaughter-bird production and product quality for more info.*).

### **Vaccinations**

Breeding birds are vaccinated annually when putting them into breeding paddocks at the start of the new breeding season. There are various vaccines; the most important disease against which ostriches must be vaccinated is Newcastle disease. Immunity will then be transferred from the female to the chick via the egg. A health programme as discussed with flock veterinarian is followed (*Refer to Ch. 11: Health management for more info.*).

### **Separation of sexes**

It is advisable to separate males and females for the duration of the rest period, and that they are kept out of sight of each other. This is the time during which breeding birds have to build up reserves for the new breeding season, and thus it is necessary for them to be calm and restful.

### **Cull unproductive birds**

During this time problem birds are culled and, if records have been kept, the following need to be checked:

- Females with high egg production, but low chick production.
- Females with very low or no production over more than one breeding season
- Females that consistently lay small, dull or malformed eggs
- Males that are unable or struggle to mate
- Old males, particularly where a high percentage of infertile eggs occur
- Birds with injuries

Breeding records are important, to enable the producer to select a flock with good egg and chick production. The only way that breeding records can be kept is to identify the breeding birds. The identification process begins by marking the eggs that are collected, followed by a wing tag for the day-old chick and then an adult neck or wing tag for older chicks of 4-6 weeks. In this way, records of breeding birds can be compiled over years and generations. The records will enable the producer to cull unproductive and uneconomical birds. A female could lay a maximum of 15 to 16 eggs per month, but this is unlikely with natural rest patterns; however, a good producer could be expected to lay an average of 8 to 10 eggs per month.





## Breeding Season

All treatments should be completed by the time breeding birds are back in their breeding paddocks. Any stress during the breeding season will lead to lower or no egg production.

There are various breeding systems, the most common of which is pair mating, trios and flock mating.

### Pair mating and trios

With pair mating a male and female are put in a paddock of approximately 0.25 hectare. This is the more expensive system, but has the advantage that detailed records of egg and chick production can be kept. At the end of the breeding season it will be clear whether the pair have performed according to expectation or whether they should be replaced. It is sound management to put the female in the paddock first to give her the opportunity to explore the area before the male joins her.

Each breeding paddock should have feed bins and water troughs and there should be sufficient shade, especially in hot areas. Adjoining paddocks should preferably be separated by an alley of about one metre in order to ensure that males do not fight and injure themselves. It also makes egg collection easier.

In the case of trios, a single male is placed in a breeding paddock (0.25 ha) with two females. Although females will lay eggs together in one nest, a female usually lays eggs of a specific form and mass. This close relationship is used to distinguish between the eggs of the two females in the breeding pen. There is always the possibility that the male mates with only one of the females, in which case the female that is not producing fertile eggs must be identified, so that she can be culled.

As soon as mating has happened, the male will start preparing a nest. Mating could occur more than once a day and the females lay their eggs mainly in the afternoon.

### Flock mating

With flock mating, males and females are kept in large paddocks or veld in a 6:10 ratio. The size of the paddock is dependent on the size of the flock. Research has shown that up to 10 ostriches could be kept in a 0.25 ha sized paddock, with still satisfactory egg production. Individual records are probably not possible with flock mating, although current research may be able to find solutions.

Feed bins and water troughs should be placed at different points, as males will patrol different areas. There will be a number of nests in which females lay their eggs. Females are also inclined to move around and will not necessarily lay eggs in the same nest throughout the season. Record keeping, in order to monitor individual birds, is impossible in a flock paddock, and it is almost impossible to identify non-producers. Nevertheless, in some instances, it could be ascertained through observation





whether mating took place. The male normally mates from the left side, and thus the tail feathers on the female's left side will appear damp and dirty.

Guidelines have been established for the utilisation of grazing for ostriches; this information is available at the SA Ostrich Business Chamber in Oudtshoorn. Because ostriches are usually fed, they are often kept in large camps, to serious detriment of the veld. According to grazing guidelines, no ostriches should be kept on natural veld, and breeding flocks may only be kept in a breeding camp for one season, where-after the camp must be rested for two years. The flock density on the veld must be in accordance with the carrying capacity standards for the specific area.

Vermin is also a serious problem in flock camp, but good jackal-proof fences largely prevent egg losses.

## Feeding

Good, balanced feeding of breeding birds is essential and is discussed in *Ch. 3: Ostrich nutrition guidelines*.





## 7 | Natural And Artificial Hatching Of Ostrich Eggs

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### Introduction

In contrast to other poultry such as fowls, the artificial incubation of ostrich eggs is characterised by low hatchability ( $\pm 45\%$ ), high infertility ( $\pm 20\%$ ) and many shell deaths ( $\pm 30\%$ ).

### Rest Period

It is important that breeding birds are not disturbed during the breeding season, as it may lead to a break in production. For this reason, the handling of breeding birds is limited to the rest period from February to April/May.

In a natural breeding system, breeding pairs are able to produce approximately two clutches per season, with around 15 eggs per nest, depending on the length of the breeding season. Breeding pairs may be left to incubate the eggs themselves or the brooded eggs may be removed from the nest after about two weeks to be incubated further artificially in an incubator. At least five eggs should be left in the nest for the breeding pair if they have to rear the chicks.

Presently the artificial incubation of ostrich eggs is the most commonly used system. With this system, eggs are collected daily, sanitised and put into storage. From storage, they are transferred weekly to incubators for artificial incubation.

### Hatchability

The hatchability of ostrich eggs is influenced by various factors at different stages of incubation.

#### Before the eggs are laid

##### ***Age of the breeding birds***

Males normally reach sexual maturity at 3.5 years and females at 2.5 years. The production and fertility of breeding birds in their first breeding season are often poor. Young breeding pairs reach their full breeding potential only in their third breeding season. Ostriches can get very old and breeding females of 15 years are quite common (*Refer to Ch. 5: Reproductive management of breeding birds for optimal reproduction efficiency for more info.*).

##### ***Breeding***

Inbreeding lowers fertility and production (*Refer to Ch. 4: Breeding of ostriches for more info.*).





### **Mating season**

Birds must have a rest period to replenish their reserves. The mating season of ostriches in the Little Karoo often lasts from May to the end of January. Fertility and production decrease naturally during autumn (*Refer to Ch. 5: Reproductive management of breeding birds for optimal reproduction efficiency for more info.*).

### **Flock Size**

With flock mating, the ratio is usually six or seven males for every ten females. Flocks should not comprise of more than 60 birds and, where veld camps are used for flock mating, the long-term grazing capacity should not be exceeded.

### **Feeding**

To ensure normal development of the embryo, the egg should contain the correct amounts of nutrients. Minerals and vitamins are particularly important in the breeding rations. Shortages in certain minerals and vitamins may result in large-scale embryonic mortality during the incubation period of 42 days. A mineral-vitamin premix should therefore always be included in the rations. Rations for good production do not necessarily render good hatching results.

### **Parasites**

Internal parasites may cause serious nutrition shortages. A basic health programme should be followed in which the breeding birds are treated for both internal and external parasites. Treatment should mainly take place during the rest period (*Refer to Ch. 11: Health management for more info.*).

### **Stress**

Dominant males that are constantly fighting contribute to stress in the flock and should be removed. Breeding paddocks should preferably not be close to busy roads. Vermin and dogs may cause stress that could impact on production. The handling of breeding birds during the active breeding season may also have a negative effect on egg production therefore do most of the handling during the rest period.

### **After eggs have been laid until setting in incubator**

#### **Collection of eggs**

Collect the eggs once a day, preferably in the late afternoon after the birds have laid or early in the morning. Due to the absence of a cuticle on the outer surface of ostrich eggs, microbes could easily penetrate the shell through the pores if eggs are not collected soon after being laid.

#### **Disinfection of eggs**

Eggs must be disinfected as soon as possible after collection and moved to the store room. Eggs may be washed, fumigated, or disinfected by ultra-violet lighting, all with equal success. A higher ratio of late shell-deaths occurs when eggs are cleaned with a hard brush to remove excess soil and dirt. The brush forces dust and bacteria into the pores of the shell, which impairs hatchability.





### ***Disinfection of eggs:***

- Fumigation: Use 80 g Potassium permanganate and 130ml formalin (40% solution) for every 3 m<sup>3</sup> incubator volume to be disinfected. The gas is dangerous and safety measures should be applied. Use a closed container with air vents for the fumigation of the eggs. Close the air vents for 20 minutes and then open the vents and doors to allow the excess gas to escape.
- Washing or spraying of eggs: Any registered disinfectant for ostrich eggs may be used for the washing or spraying of eggs and incubators. It is important to use lukewarm water to wash the eggs. If the water is too cold, the shell pores shrink and allow pathogens to enter the egg. It is also important that the eggs should not be immersed in the water while washing, the luke warm water must be poured over the egg by hand. Since the effective action of wet disinfectants is influenced by the contact period on the surface of the egg shell, the eggs should be left to dry by themselves in a drying rack or egg basket, and not dried with a cloth. The longer the contact with the shell surface, the more effective the antibacterial action will be.
- UV exposure: Eggs are placed in an ultraviolet (UV) machine. The machine contains a number of UV lights and should be designed in such a way that the UV rays present no health risk to the operator. For optimal exposure, eggs should be allowed to rotate slowly for 20 minutes through an angle of 360°.

### ***Pre-storage heating***

Pre-storage heating comprises of the heating of eggs after disinfection and before they are stored. Eggs are set in an incubator for approximately 4 hours at 36°C. The pre-storage heating is a simulation of the longer periods that eggs are in the nests – before the female starts incubation. The heating initiates the development of the blastoderm up to a certain stage, where after any further development is halted by storing the eggs. Pre-storage heating may result in a significant decline in late-death embryo mortality. Pre-storage heating is an optional management practice.

### ***Storage of eggs***

The optimal temperature for storage of ostrich eggs is 15 to 20°C, with a relative humidity of 75 to 80%. Eggs should not be stored for longer than 7 days, for longer storage periods cause a reduction in hatchability. Temperature fluctuations during storage, particularly temperatures higher than 25°C, could also lead to a higher percentage of late-death embryo mortality.

The air-cell position of the egg may be either horizontal or vertical during storage, but the eggs should be turned at least once a day. When transported over long distances, the eggs





should afterwards be left unhindered for approximately 12 hours, to allow them to stabilise.

### ***Pre-set heating of eggs***

Before eggs are set in the incubators, they should be acclimatised for at least 12 hours at a room temperature of 25°C. Although there is no change in the hatchability, the sudden change in temperature may cause condensation on the shell of the cold eggs. This causes an increase in the humidity inside the incubator, which in turn enhances the environment for the growth and multiplication of microbes.

### **In the incubator**

#### ***Position of the air cell***

The position of the air cell, approximately 2.5cm in diameter in a fresh egg, is determined with the aid of a torch in a dark room. Mark the air cell clearly with a pencil. It is important to identify the position of the air cell, as the incubation of eggs with the air cell at the bottom results in large-scale shell mortality.

#### ***Temperature***

Temperature is the most critical incubation parameter. The incubating temperature should be 36°C with fluctuations not exceeding 0.5°C. Research has shown that deviations of 1 to 1.5°C above the allowed temperature could result in 50% more early embryonic mortalities.

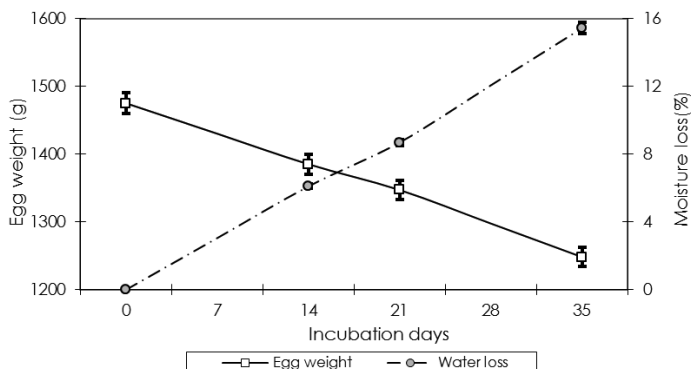
#### ***Guidelines to overcome the problem:***

- Invest in a good thermometer.
- Set the correct temperature before the eggs are set. It is difficult to change the temperature when the incubators are already full.
- Determine the warm and cold areas in the incubator.
- If temperature differences occur in the incubator, eggs should be placed in such a way that they are in the coolest part of the incubator during the last two weeks of incubation.

#### ***Moisture***

The reading of the wet bulb thermometer will be determined by the weight of the eggs. To determine whether the moisture loss is correct, chick weight at hatching should be approximately 64% of the original egg weight; put differently, the egg should lose approximately 13 to 15% moisture during the first 35 days of the 42-day incubation period. To achieve this, the relative humidity in the incubator should not exceed 28%. Figure 7.1 indicates the relationship between egg weight and the percentage moisture loss during incubation.





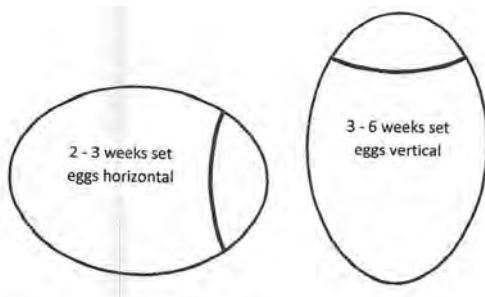
**Figure 7.1** Relationship between egg weight and the percentage moisture loss during incubation.

### ***Setting of eggs in the incubator***

Determine the warm and cold areas in the incubator before the eggs are set. Fresh eggs should be set in the warmest parts and incubated eggs moved to the cooler parts. Temperature differences at any one point in the incubator should not exceed 0.5°C.

### ***Position and turning of eggs during incubation***

The angle through which eggs are turned during the incubation process is very important for the successful development of the blood-circulatory system, which will result in a healthy embryo. The ideal angle of turning is at least 90°. When purchasing electronic incubators, the angle of turning of the trolleys should be checked. If the angle of turning is through 90°, eggs can from day one be set upright in the baskets. If the angle of turning is less than 90°, the eggs have to be incubated horizontally for the first two to three weeks and after that vertically, with the air cell to the top (Figure 7.2). The latter is also applicable for all incubators in which eggs have to be turned by hand.



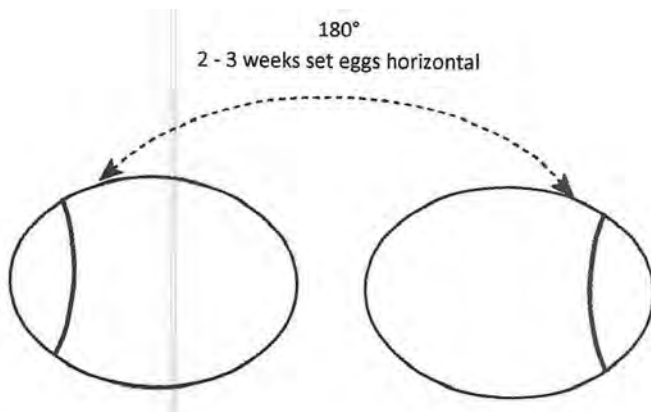
**Figure 7.2** Position in which eggs are incubated for the six weeks of the incubation period if turned by hand or if angle of turning is less than 90° in the incubator.



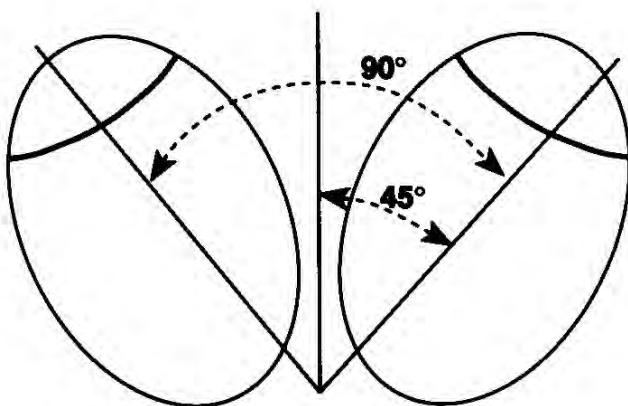




Electronic incubators turn the eggs 24 times daily. In cases where eggs are turned by hand, it is done twice or thrice daily (Figures 7.3a and 7.3b).



**Figure 7.3a** Turning of eggs through an angle of 180°, point to point.



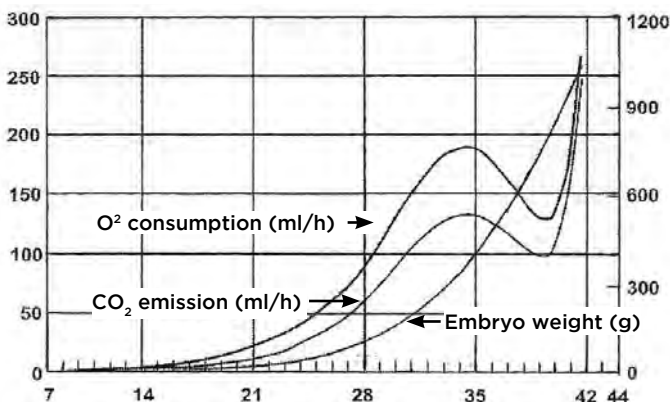
**Figure 7.3b** Turning of eggs through an angle of 90°, with a 45° gradient from left to right.

After 5 weeks of incubation in the setters, the eggs are transferred to the hatchers for the last week before hatching takes place. During this period the eggs are no longer turned.

#### **Air flow**

Provision should be made for adequate, but not excessive ventilation in the incubator. Large temperature fluctuations must be avoided. Air flow of approximately 45 l/hr/egg, which maintains a carbon dioxide level of less than 0.5% in the incubator, is recommended.





**Figure 7.4** Gas exchange during incubation

### **Power failures**

During power failures, the incubator doors should be left slightly open. A few hours of cooling are less harmful to embryos than the build-up of carbon dioxide. Ideally, provision should be made for an emergency generator which could be used during power failures

## **Critical Periods of Embryo Development**

Embryo mortality has two peaks during incubation – during the early and during the late incubation period.

### **Early period (up to 14 days)**

This period coincides with two important physiological changes, namely:

- Development of the blood circulatory system,
- Change from a simple carbohydrate diet to a complex protein and fat diet.

### **Late period (14 to 35 days)**

More than 50% of all embryonic deaths occur at this stage. The embryo normally develops with the head close to the air cell and the beak next to the right foot. Figure 5 indicates the orientation of the embryo in the case of a late embryonic death.



**Figure 7.5** Orientation of the ostrich embryo at the time of late embryonic death





### *Abnormal positions*

- Head between the legs
- Head in the narrow end of the shell
- Embryo turned in such a way that the legs are not close to the air cell
- Feet folded over the head
- Beak positioned over right wing

Although some chicks in these positions do hatch, these positions mostly lead to shell-deaths

## **Choice Of Incubators**

In most cases the choice of an incubator is determined by the price. Although the cost per egg set in wooden incubators is significantly lower than the cost of eggs incubated in electronic incubators, wooden incubators require special management skills in order to deliver incubation results similar to electronic incubators.

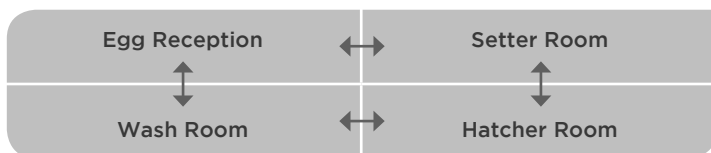
A thorough study of the temperature and relative humidity in the particular farming area should be made before deciding what type of incubator to purchase. Controlling the incubator environment is often so expensive that it would be more cost-effective to acquire an electronic incubator that can function optimally under widely varying environmental conditions.

### *Design of Hatchery*

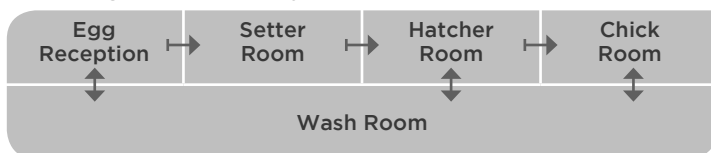
In the planning of a hatchery, provision should be made for the following:

- A reception area where eggs can be disinfected or fumigated
- Store room for eggs
- Setter room
- Hatcher room
- Chick room
- Wash room

**The construction of the hatchery must enable one-way flow**



**Ideal design of the hatchery**



Good management practice often leads to high hatchability and good quality chicks.





## Chick Quality

A considerable number of defects and abnormalities in chicks originate in the incubator. Possible causes of such defects and abnormalities are given in Table 7.1.

**Table 7.1** Possible causes of defects and abnormalities in chicks

Observations	Possible cause
Sticky chicks	<ul style="list-style-type: none"><li>• Low incubation temperature</li><li>• High humidity</li><li>• Insufficient turning of eggs</li><li>• Very large eggs</li></ul>
Pieces of shell clinging to feathers	<ul style="list-style-type: none"><li>• Low humidity</li><li>• Poor shell quality</li><li>• Insufficient turning of eggs</li></ul>
Early hatching with bloody navels	<ul style="list-style-type: none"><li>• Too high an incubation temperature</li></ul>
Small chicks	<ul style="list-style-type: none"><li>• Small eggs (94% genetically correlated)</li><li>• High incubation temperature</li><li>• Thin shells</li></ul>
Swollen navels with dry down feathers	<ul style="list-style-type: none"><li>• High temperature in setter or large temperature fluctuation</li><li>• Low temperature in hatcher</li><li>• High humidity in hatcher</li><li>• Poor feeding</li></ul>
Large, swollen, soft navels - with a bad odour	<ul style="list-style-type: none"><li>• Yolk-sac infection</li><li>• Dirty incubators</li><li>• Low incubation temperature</li><li>• High humidity</li><li>• Poor ventilation</li></ul>
Crooked toes and muscular legs	<ul style="list-style-type: none"><li>• High and low incubation temperature</li><li>• Poor feeding</li><li>• Smooth hatching baskets</li></ul>
Deformed chicks	<ul style="list-style-type: none"><li>• Poor storage conditions of eggs</li><li>• Breeding</li><li>• Poor feeding</li><li>• Insufficient turning of eggs</li><li>• High and low incubation temperature</li><li>• Poor shell ventilation</li></ul>
Short, hard down	<ul style="list-style-type: none"><li>• High incubation temperature</li></ul>





Observations	Possible cause
Closed, sticky eyes	<ul style="list-style-type: none"><li>• Too high a temperature in hatcher</li><li>• Too low humidity in hatcher</li><li>• Chicks stay too long in hatcher room</li><li>• High air flow in hatcher room</li></ul>
Small chicks which do not grow	<ul style="list-style-type: none"><li>• Infection during incubation</li><li>• Diseases in breeding birds</li><li>• Genetic</li><li>• Malnutrition</li><li>• Thyroid abnormality</li></ul>
Short beak, or abnormalities of the head	<ul style="list-style-type: none"><li>• High incubation temperature in the beginning stage (<math>\pm 1-14</math> days)</li><li>• Genetic</li><li>• Lethal genes</li><li>• Malnutrition</li></ul>





## 8 | Artificial Rearing Of Chicks

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### Introduction

Successful rearing of ostrich chicks is a challenge for any producer and requires good management. Chicks can be reared in two ways, i.e. artificially (by man) or naturally (by breeder birds). In cases where ostrich chicks are reared artificially, good management practices are of utmost importance.

### Quality Of Chicks

The success of any chick-rearing setup is influenced by the quality of the chick. When buying chicks, the chick-rearer should make sure to purchase good quality chicks. A chick of good quality will be heavy enough and without physical defects. The chick-rearer should have a sound knowledge of the grading of day-old chicks and know what to look out for when purchasing from a hatchery. It is very difficult to successfully rear chicks of poor quality.

#### Grading of day-old chicks

The following aspects should be noted when day-old chicks are graded:

##### **Weight**

First-grade chicks should weigh more than 750 g at one day of age. It is important that the age of the chick is taken into account when its weight is considered, because chick mass decreases during the first few days after hatching, until approximately day 4, before increasing again. Day-old chick mass is closely related to egg mass. Setting eggs with a minimum mass of 1.3kg will ensure that first-grade chicks can be obtained, given optimal incubation conditions (*Refer to Ch.7: Natural and artificial hatching of ostrich eggs for more info*). Chicks weighing less than 750 g are classed as second grade. Chicks with physical defects are classed as third grade, irrespective of mass.

Chicks should be transferred to rearing facilities and provided with food and water as soon as possible after hatch as this will aid with absorption of fat from the yolk.

##### **Condition of navel**

The navel of day-old chicks should not show any signs of infection and should be contracted inward.

##### **Body form**

Puffy chicks with swollen abdomens are classed as third grade. Such chicks usually struggle to move normally. Abnormalities of the legs, such as splayed legs or crooked feet, also result in chicks being downgraded to third grade.





## Housing

The rearing facilities for chicks should be clean and pre-heated to ensure that the chicks will not be cold when they are first placed in the facilities. Ostrich chicks should be kept at a temperature of approximately 26°C for the first two weeks. Large temperature changes must be avoided during the early stages. The temperature should be monitored regularly to ensure that the immediate environment of the chicks is at the optimal temperature to ensure normal behaviour. Overhead heaters and/or rings can be used in chick houses to keep chicks warm at night. Spot heating must be prevented, as it leads to temperature fluctuations that could adversely affect the wellbeing of the chicks. Open beaks and spread wings are an indication that the chicks are too hot, which could lead to diarrhoea. Chicks that are too cold will climb on top of one another, which could in turn result in skin damage. These chicks will also not grow optimally due to using their energy to keep warm.

Before letting the chicks go outside, the outside temperature should be checked. Chicks should only be allowed outside once it is warm enough. If the chicks are let out in the mornings, the chicks should be gradually acclimatised by removing the heat source to allow gradual cooling of the sleeping area. This way the chicks will not be exposed to too great a temperature difference when they are allowed outside (*Refer to Ch. 9: Housing of ostrich chicks for more info*).

## Feed And Water

Chicks must get a balanced diet right from the start. Food and water troughs should be cleaned regularly and enough food and drinking water should be available at all times.

Sound feeding management should be practised to eliminate problems. Fresh palatable food with a good texture should be provided. The feeding behaviour of chicks should be monitored to ensure sufficient feed intake for optimal growth. When rations are changed, the chick should be accustomed to this gradually. This is done by systematically mixing more of the new ration in with the old ration. Any sudden change in the feed may result in chicks going off their feed.

Chicks must be given free access to feed (fed *ad libitum*) from the start. In the early stages fresh feed should be provided in the mornings and afternoons. This way food intake can be closely monitored. A sudden drop in food intake is an indication of disease and should be attended to immediately.

The type of ration fed to chicks is determined by their body mass. Typically the different weight groups and rations are:

- 0-10kg body mass: Pre-starter crumbs/meal
- 10-40kg body mass: Starter crumbs/meal





- 40-60kg body mass: Grower pellets
- 60-90kg body mass: Finisher pellets
- >90kg body mass: Maintenance pellets

The provision of enough fresh drinking water is important for chicks as it influences feed intake. Water should be clean and free of bacteria. It is essential to clean and disinfect water pipes thoroughly before each season. Water troughs should be disinfected weekly. It is also important to monitor the temperature of the drinking water. Too hot or too cold water will affect water intake and is detrimental to normal digestion. Feed intake of dry rations will also decrease if water intake is insufficient.

The chicks should be given stones if they do not have access to natural stones, as stones (gastroliths) are needed for proper digestion (*Refer to Ch. 3: Ostrich nutrition guidelines for more info.*).

## Medicine

Sick chicks must be identified early and treated as soon as possible. The behaviour of the chicks and the appearance of their excrement is a good indication of their health status. Sick chicks should preferably be removed from the group and treated separately. A good practice is to have a separate enclosure or paddock where sick chicks can be kept and treated. This will limit the potential spread of diseases.

*Post mortem* investigations should be done to determine the cause of deaths. If necessary, the rest of the flock needs to be treated. If the cause of death is uncertain, the local veterinarian should be consulted.

Medicine must be stored under the correct conditions and be used with caution. Consult the packaging of medicines for the correct storage conditions and directions for use. A register should also be kept of all purchases and usage of medicine, according to the Veterinary Procedural Notice (*Refer to Ch. 11: Health management for more info.*).

## Transport Of Day-Old Chicks

It is important to transport chicks correctly in order to prevent injuries. Crates lined with a slip-proof, clean fabric such as rubber matting, could be used. Generally no more than 10, day-old chicks should be transported per crate. The size of the chicks, time of day, distance of travel and the season during which the chicks are transported, will all influence the number of chicks per crate. For transport over long distances it is recommended to load no more than 8 chicks per crate.

Temperature fluctuations during loading and transport of chicks should be avoided. Crates may be stacked during the journey, but care should be taken to prevent injuries and to allow







adequate ventilation between crates. Chicks should be handled with care when put into or taken out of crates – they should be picked up with the necessary support to the body

## General Guidelines For Rearing Of Chicks

With rearing of chicks the following basic aspects are important:

- Good management.
- Adequate and suitable infrastructure or housing facilities must be available to protect chicks from inclement weather conditions.
- Facilities should be kept clean and dry.
- A set routine should be followed to keep stress to a minimum.
- Limit noise and activity around the chicks.
- Practice biosecurity at the rearing unit to prevent the entry and spread of bacteria, viruses and fungi.
- Large chicks should preferably be kept away from small ones to prevent the transfer and spread of diseases from the older to the younger chicks.
- Feed and water must be of a good quality.
- Flock size should be limited – too high densities will negatively impact on growth and health status.
- Chicks need to be monitored closely in order to identify and deal with problems as early as possible.
- People involved with the rearing of chicks should have the necessary knowledge and training to be able to identify and treat problems.

## Natural rearing

Chicks may also be reared naturally by the breeding pair. The breeding pair is normally left to brood a nest. As soon as the chicks have hatched, the pair may be moved to a more suitable location, such as a Lucerne paddock, where they can rear the chicks. More chicks of similar size (or smaller) may be added to chicks already hatched by the breeding pair. Any one pair could cope with as many as 60 (or more) chicks. Always add chicks of the same age or younger (smaller), because a breeding pair will not accept bigger chicks. Chicks that appear larger than their own hatched chicks will be killed by the male.

Because a breeding pair can only cover about 25 chicks at night, additional shelter should be provided for the rest of the brood if more than 25 chicks are placed with the breeding pair. Chicks could be reared by the breeding pair up to the age of approximately 3 months.

The number of chicks and their management will depend on the chick rearer. The two systems that are usually followed are:





1. A breeding pair is given a number of chicks and allowed to rear the chicks until the end of the season or until the chicks are big and strong enough.
2. Alternatively a breeding pair may be provided continuously with chicks of a certain age. When then chicks get older, they are moved to another breeding pair which will rear them for the next period. With this system a breeding pair could thus care for more than one group of chicks and the pair could be used for a longer period of time. In the former system every breeding pair rears only one group of chicks during the season.

Chicks placed with breeding pairs receive the same feed as in the artificial system, while they usually also have access to fodder such as Lucerne. It is important to prevent the breeding pair from ingesting the chicks' rations. If this happens, they may go into a reproduction phase again, in which case they could peck the chicks to death. The breeding pair should receive only maintenance rations for the duration of chick rearing. The chick feed could be placed under a low frame structure or shade cloth, which will prevent the adult birds from getting to it. A simple fence that only allows the chicks' access can also be used.

Not all breeding pairs are equally suited to foster and rear chicks successfully. The following should be considered when selecting a breeding pair:

- The breeding pair should have a full crop of feathers to adequately protect the chicks.
- Foster birds should preferably be tame, as excessively aggressive birds may trample the chicks to death. Breeding pairs used as foster parents for the first time should be monitored closely to ascertain whether they will be successful foster parents.

The following problems may occur:

- Sometimes it is difficult to find a pair that display good foster-parent traits. Often the male is a better foster parent than the female.
- Chicks sometimes prefer to settle under the male only. As a result some chicks may not be protected against the elements, as a breeding bird can only cover 10-15 chicks (depending on size) under the wing.
- Pairs sometimes will not accept additional chicks and will kill the chicks by pecking or trampling them, or by throwing them into the air.
- One or both parents may not want to settle down when it gets dark, resulting in chicks getting lost in the dark and then sleeping in the open/cold where they might freeze to death.





Chicks are usually reared more successfully by foster parents than in artificial systems. Behavioural problems such as eating sticks and soil almost never occur in the first system. The breeding pairs teach the chicks what to eat and what not to eat. Stress, which is the most important reason for behavioural and other problems in chicks that are hand-reared, is largely eliminated when chicks are reared by foster parents in a natural environment.

With artificial rearing, chicks are more inclined to experience their environment as stressful, and management plays a bigger role. The rearer should know how to compensate for this in order to rear chicks successfully





## 9 | Housing Of Ostrich Chicks

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### Introduction

Articles on the rearing and housing of ostrich chicks often appear in the popular press in South Africa. Despite the long history of the local ostrich industry, many problems still occur resulting in high chick mortalities, particularly during the first few weeks after hatching. Producers who successfully rear ostrich chicks seem to have a unique housing system and/or rearing programme. However, when other producers use the same system on another farm, they are often not as successful. This means that other factors, and not necessarily the type of housing system, determine the success of a particular rearing system. Sometimes producers initially experience positive results with a new system, which then encourages them to expand the operation. Unfortunately, often this expansion in chick numbers does not always include an expansion of the original housing facilities. This then often results in an increase in the number of chick mortalities and poor growth rates among young birds.

Clear guidelines on the best floor surfaces, floor- and feeding spaces, the need for providing shelter like shade and windbreaks have not yet been established for ostrich chicks. Most of the available methods and standards being applied have been established through observations and are not quantified. It is generally accepted that the success of an ostrich rearing enterprise is largely dependent on the success rate of rearing ostrich chicks during the first three weeks of life. The natural behaviour of ostriches and their chicks should be taken into consideration in creating suitable housing facilities for chicks specifically. High mortalities do not commonly occur among adult ostriches and they are not usually kept in intensive systems as is the case for newly hatched chicks. For this reason this chapter will concentrate mainly on the housing of newly hatched chicks up to six months of age.

### The Natural Environment Of Ostriches And Chicks

Ostriches evolved to live in desert, semi-desert and savannah plains conditions and are therefore well adapted to reproduce in these environments. Their specific body shape makes them well adapted to these conditions. Their legs are long, without any feathers for better radiation of body heat. The neck is long and thin with the head high above the ground. In desert-like conditions the air temperature close to the ground may be as





high as 50°C because of radiation, while around the ostrich's head it is probably between 30 to 35°C. The eggs are hatched on the ground and the body heat of the female and male sitting on the eggs alternatively, protects the embryos against the excessively high and low ambient temperatures occurring during the day and night respectively.

In nature, the environment in which ostrich chicks hatch and live is relatively disease free. Pathogens need a medium to grow on as well as minimum moisture levels to multiply and to sustain growth. The high air temperature close to the ground dries out the faeces and urine of the male and female birds while the ultra-violet rays in sunlight has a sterilizing effect of the ground in the vicinity of the hatching site. Furthermore, the number of chicks per unit area is very low and little contact occurs between different breeding groups. Because of the danger of predators, the male and female together with the chicks quickly move away from the hatching site. Thus the danger of contamination of chicks at the hatching site is completely eliminated. Ostriches, as a rule, do not show clear maternal instincts similar to mammals, but there are nevertheless signs that they are concerned about the newly hatched chicks. This behaviour and specific sounds made by the parents have a calming effect on the young chicks. In nature, where the risk of danger from predators is high, this behaviour will reduce stress levels in the young chicks.

## **The Environment Of Artificially Hatched And Reared Ostrich Chicks**

None of the above-mentioned conditions apply in the artificial environment in which ostrich chicks are hatched and reared for commercial purposes. Chicks are hatched in incubators at approximately 36°C. After hatching, they are kept in different types of housing systems in groups of up to 100 birds. Housing systems vary from intensive to extensive systems. In the latter system chicks sometimes have access to cultivated Lucerne pasture. Within each system, attempts are often made to protect the chicks against unfavourable climatic conditions. Additional heating is provided by heaters hanging from the ceiling of buildings with the aim of keeping the ambient temperature at approximately 25°C to 26°C. In an attempt to prevent young chicks from being exposed to drafts, the buildings in which they are housed are often closed up tightly. Unfortunately this results in a rapid increase in the humidity levels of the air inside the building. As the ventilation in buildings is often not optimal, the ammonia level in the air also rises rapidly. This could then lead to respiratory tract diseases in young chicks.

Ostrich chicks are efficient at thermoregulation from an early age. The ability to thermo regulate from an early age does not, however, imply that young ostrich chicks will not suffer from





hyper or hypothermia. The maintenance of body temperature also incurs at an energetic cost for small chicks. Although thermoregulatory behaviours (like lying down and huddling at lower temperatures) may reduce thermoregulatory costs, they also compete with feeding activities, which may result in shorter feeding times and reduced growth rates. Hypothermia results in a decrease in metabolic activity causing failure to absorb or utilise the yolk, thus resulting in weak, lethargic chicks. A below normal body temperature also retards the development of the immune system in young chicks, making them very susceptible to respiratory tract and other infections.

In extensive systems only limited heat is usually provided with chicks often being kept at room temperature. However, this temperature depends on the immediate ambient temperature. On a hot, sunny day room temperature could be considerably higher than 25°C, while on a cool, cloudy day it could be substantially lower. However, the most serious problems occur when chicks, very shortly after hatching, are packed into containers and transported over great distances to a new environment where they are to be reared. During transportation, the chicks are often exposed to very low or very high ambient temperatures. Under these circumstances the newly hatched ostrich chick uses much of its body reserves just to keep its body temperature at a normal level. The duration that chicks are exposed to unfavourable temperatures is of greater importance than the extremity of the temperature fluctuation (i.e. 10 degrees below the optimal for 15 minutes, is less harmful than 5 degrees below the optimal for 4 hours).

The chick can survive on its yolk sac only for a limited period. During this period it has to learn to move around, get to know its environment and learn to eat and drink water. Also, unlike in nature, there are no older birds to teach chicks through their behaviour where to find feed and water. Chicks therefore must find out by themselves where the feed troughs are and start to feed. The ambient temperature in which the newly hatched chicks find themselves should be such that their limited body reserves, located in the yolk sac, are rather used to explore their surroundings and start eating and drinking and not to regulate their body temperature. It is therefore critical that a chain of warm ambient temperatures are maintained for young chicks to be able to keep their body temperature at a normal level. The temperature in the housing system may be reduced gradually as the chicks grow older.

Adequate ventilation must be provided in the room where the newly hatched chicks are kept. The air inside such a room should be replaced every four hours. Ventilation should occur without drafts exposing the chicks to cold shocks. Hot air being





blown slowly (at a speed of 0.5 m per second) close to the floor of the building should ensure adequate ventilation without reducing the ambient temperature. The hot air would rapidly dry out the faeces and urine collecting on the floor. This will prevent the creation of an ideal environment for pathogens to grow. The humidity levels inside a housing system should ideally not exceed 30%. The air that enters the building at night in particular will have to be heated to prevent cooling of the building.

## **Feed Troughs And Feeding Space For Young Chicks**

It is a common practice in the ostrich industry to provide feed to newly hatched ostrich chicks in open, flat trays distributed across the floor. Some producers also scatter the feed directly onto the floor in an effort to stimulate feed intake. It is a natural behavioural pattern in young chicks to start moving around pecking at all objects within their reach within a short time after hatching. In this way chicks eventually discover the feeding trays resulting in a gradual increase in their daily feed intake. This practice is problematic in artificial environments where chicks are on cement flooring as chicks will also peck at the droppings of other chicks quite readily. Some producers are of the opinion that this is a natural process, allowing the intake of certain bacteria essential to the digestive processes in the stomach. Unfortunately, if pathogens are present in the faeces of a certain chick, these organisms will spread to other birds. In nature the intake of faeces is probably relatively low, because the droppings of the parents and other chicks occur over a wide area. It also dries rapidly and is sterilized by the sun, reducing the risk of pathogens considerably.

The open, flat feed containers on the floor also provide a soft place for small chicks to lie down and feed trays are often used for a dust bath. Because it is easy to walk across the flat feed trays, feed become polluted very quickly. This will reduce the palatability of the feed and therefore the intake.

For ostrich chicks less than 8 weeks of age, feed should be available for at least 10 hours per day. Like for other animals, feed troughs for young ostrich chicks should put at the side of the paddocks to allow chicks to feed only from one side.

Ample feeding space should be provided. The number of chicks and frequency of feeding will determine the length of the feed troughs. If all the chicks are feeding at the same time, a feeding space of approximately 15-20cm per chick is required. However, if the feed troughs are full all the time, the feeding space per chick could be less, approximately 5-10cm per chick, seeing as all the chicks won't be feeding simultaneously. A larger feeding space should be provided as the chicks grow older and bigger. The linear distance between the outside of the thighs determines the feeding trough space per chick. The feeding





troughs should preferably be at least 10cm wide to facilitate the natural scooping movement of the beak when feeds in the form of meal are consumed. The opposite side of the feed trough from where chicks are eating can slope upwards to make this scooping movement easier.

A partition placed approximately 20cm above the feed trough will prevent chicks from climbing into the troughs and polluting the feed. However, the space between the top of the trough and the partition should be big enough for the chicks to eat freely.

Sufficient fresh feed should be provided daily to ensure an *ad libitum* intake, while avoiding feed from becoming stale and unpalatable. Enough fresh, clean drinking water should be available at all times. A number of watering points should be provided to allow every chick free access to clean drinking water.

## Housing Of Chicks

Presently opinions differ considerably with regards to the maximum density of newly hatched chicks and growing birds to be accommodated inside housing systems and paddocks. As with other livestock, the surface area per bird varies with the age of the chicks and production system.

Currently most housing systems for newly hatched ostrich chicks consist of a building with an exit for the chicks to go outside when the weather permits. However, a large variety of housing systems are currently in use, including shipping containers, wooden or corrugated-iron huts, and pig or poultry housing adapted for ostrich chicks. Floor surfaces being used include soil, concrete, concrete covered with rubber mats or galvanised steel wire mesh, slatted floors or gravel

Overseas authorities recommend that newly hatched ostrich chicks should preferably be kept in an environment where the microclimate could be kept artificially at 30°C. As the chicks become older, the air temperature could be gradually reduced by of 0.5°C per day to 26°C. Possible heat sources that could be used include infrared, oil or electric heaters. A ceiling in the roof would also help to control the microclimate. In South Africa chicks are not kept at such high temperatures and artificial heating is not used as often. However, chicks should be protected against unfavourably low temperatures. Plastic tunnels are also often used to protect chicks at night. Inside the tunnel, small groups of about 10 chicks each are kept inside cardboard rings with a diameter of 1 m and 50cm high. Chicks keep each other warm within this ring, without the need for external heating. Hessian can also be used to cover the rings for heat retention. Infrared and propane gas heaters can also be used within ostrich housing facilities if external heating is required.

The walls and floors of the building should be smooth and washable to be washed easily and disinfected regularly. Plastic







slats are increasingly being used to provide a clean floor surface as the faeces and urine fall between the slats, collecting on the floor underneath. However, the slats should not be smooth causing chicks to slip.

Good ventilation is required to prevent an accumulation of ammonia, humidity and carbon dioxide inside the chicken houses. Fans circulating the air slowly should be used to prevent the formation of air layers with high levels of ammonia close to the floor. As an alternative, extraction fans could be used to extract the air that accumulates close to the floor surface. Air flowing into the building as a result of the extraction should be heated to prevent it from reducing the air temperature inside the building. Ammonia levels inside the building at the level of the chicks, i.e. close to the floor, should not be higher than 20 ppm. Ammonia can be smelled when the air contains 10 to 15 ppm.

Groups of ostrich chicks should not be more than 30 to 50 birds. For ostrich chicks at approximately 4 to 6 weeks of age, the stocking density inside chicken houses should be about 3 chicks per m<sup>2</sup>. Outside runs could consist of grazing paddocks or be feedlot conditions. However, ingestion of soil can become a problem in chicks that have not been exposed to soil from day-old.

### Young Chicks (From 13 Weeks To 6 Months Of Age)

Young ostriches from 14 weeks of age have a smaller need for intensive housing. They mainly need shelter against adverse climatic conditions such as very wet, cold and windy weather. For ostrich chicks from 4 to 6 months of age the outside space should be approximately 20 to 45 m<sup>2</sup> (Verwoerd, et al. 1999). The stocking rate of young birds on pasture could be 85 to 125 birds per hectare. For older birds the stocking rate could be approximately 70 to 100 birds per hectare.

### Conclusion

In South Africa commercial farming of ostriches has been ongoing for a number of years. The fact that high mortalities occur in young chicks means that the artificial conditions under which they are hatched and raised are still not ideal. Information is still lacking with regards to the response of chicks to particular environmental and temperature conditions. These aspects should be addressed in an appropriate research programme.

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# 10 | Slaughter-Bird Production And Product Quality

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## Introduction

The commercial production of slaughter ostriches yields three marketable products: feathers, leather and meat. A slaughter producer should take all three of these products into account to optimize the income from slaughter birds. Profit margins have dropped considerably over the past decade, with the result that the quality of each product is critical to ensure profitability (*Refer to Ch. 13: Economic viability and financial management for more info*).

## Feathers

Although ostrich feathers represent only 5 to 10% of the total slaughter income from an ostrich, it could mean the difference between making a profit or a loss. Good management will contribute towards the production of good quality feathers for maximum feather income.

### Harvesting of feathers

No immature or green feathers (feathers that are not yet 'ripe', also called blood feathers) may be harvested on the farm.

The wing and tail feathers of juvenile ostriches are harvested when they are ripe, usually at a live weight of 60kg or more. It is important to harvest the feathers at the right time and degree of ripeness in order to ensure a good crop at slaughter.

Feathers of breeder birds are normally harvested during the rest period. The feathers should be harvested at the beginning of the rest period, to ensure sufficient feather growth before the start of the new breeding season (*Refer to Ch. 6: Management and care of breeding birds for more info*), as it could affect mating behaviour and production.

Ostriches need to be well-fed after the feathers have been harvested to ensure that the new feathers develop properly. Balanced rations should be given to the birds before and for at least a month after the feathers were harvested, before a change to cheaper feeding systems is considered. Ostriches sometimes show a slight decline in weight in the month after harvesting, but compensate with a rapid increase in weight approximately two months after harvesting, provided that adequate feed is available (*Refer to Ch. 3: Ostrich nutrition guidelines for more info*).

Handlers with the necessary experience in feather harvesting should be used. The different feather types are bound separately





with polytwine or baling twine into sturdy bunches of no more than 10cm in diameter (measured at the shafts). The byocks are removed from the wing feathers and bound separately. Male (whites) and female (feminas) feathers are also bound separately. Feathers should be delivered as soon as possible to prevent damage to them. If feathers are stored, they should be treated with naphthalene or paradichlorobenzene crystals to ward off moths that can cause damage during storage. Storing time must be limited as far as possible

#### Types of feathers harvested:

- **Wing quills (whites or feminas):** the first row of large plumes at the edge of the wing.
- **Byocks:** the 3 to 5 pied (black and white) feathers at the end of the row of white wing feathers.
- **Long upper wing coverts:** the second and third rows of feathers on the outer edge of the wing, above the wing quills.
- **Lower wing coverts or floss:** usually only one row of soft, downy feathers underneath the wing.
- **Tail feathers:** the long feathers on the tip of the tail.
- **Sides (bodies):** the feathers in front of and behind the thighs.

#### Feather quality

Feather income depends on the condition and quality of the feathers. The condition of the feathers affect the processing costs and therefore also the price. Badly damaged feathers should therefore be removed before being sold, whereas dirty and clotted tail feathers could be beaten out or washed.

Weathering and louse damage also greatly affect the general condition of the feathers. An effective louse control programme and prevention of weathering will ensure higher feather prices. To prevent wear and tear, wet, muddy conditions and dense vegetation in paddocks should be avoided. Feathers should also be washed (sprayed) regularly.

The following acaricide treatment programme is recommended to prevent damage from external parasites:

- Ostriches can be treated as early as 4 months of age to prevent louse damage to feathers. A follow-up treatment can be administered two weeks later to kill any lice that hatched after the initial treatment.
- Four to six weeks after the feathers have been harvested, when the follicles have healed (closed up), the ostriches can be treated again for control of feather lice and ticks. A spray treatment will help to keep the feathers clean and lessen wear. Alternatively, a pour-on treatment may be used.





- Six weeks later, or three months after plucking, the birds should be treated again. The products that are used can be alternated to prevent resistance against any specific active ingredient developing.
- The final treatment is done 14 days before slaughter, before the ostriches are taken to isolation paddocks for slaughter purposes.
- Treatment should be more frequent if the parasite challenge is high.

Feather quality is determined mainly by the traits of the feather, such as the breadth and symmetry of the feather, size and appearance, quill length and down quality (i.e. density and lustre). Selection for these traits will over time improve the overall feather quality in a herd. The ostrich type or lineage will also determine feather quality. Feathers of South African Black ostriches are generally of a better quality than those of the Zimbabwean Blue ostriches, as this lineage has been specifically developed and bred for feather quality.

## Leather

Ostrich leather is a luxury product that is deemed unique because of the presence of the feather follicles. The skin of the ostrich is therefore regarded as one of the primary products of the ostrich industry.

### Handling of farm skins

Although income is usually generated from ostriches slaughtered for their products, the skins of ostriches that died on the farm can also be sold. Important guidelines to retain the value of the skin are:

- The carcass should not be dragged by its legs, as this will leave chafe marks on the skin.
- The skin should be removed from the carcass as soon as possible.
- All the feathers must be plucked before removal of the skin.
- The skin should be removed with care so that it is not damaged.
- To skin the ostrich, make continuous cuts with a sharp knife. The callous, featherless skin across the breast is cut away first. From there incisions are made along the front of the neck and along the abdomen. The abdominal cut should be extended up to the cloaca opening at the back. Cut around the cloaca so that it is separated from the rest of the skin. Then cut through the skin around the knees. Make cuts through the skin from the middle of the breast plate along the outer wing margins, as well as from the stomach along the inside of the thighs and then sloping gradually towards the knees. Start at the crosscut on the





breast and cut the skin loose around the wings, breast and lower part of the neck. Continue to loosen the skin from the inner thighs to behind the back by carefully pulling it from the carcass and cutting it loose where necessary.

- Remove the remaining meat and fat from the skin and wash off any blood.
- If the skin cannot be delivered immediately, it must be salted thoroughly on the 'meat' side. Medium to coarse salt can be used. The quantity of salt should be approximately equal to the weight of the skin. Allow the salt to extract the water and let the excess water run off before the skin is rolled up.
- The skin should be taken to the tannery as soon as possible, or, alternatively, be stored in a cool place until it can be delivered.
- The skin can be covered with damp hessian soaked in a saturated salt solution to prevent it from drying out.
- For transporting, the skin should be rolled up in double hessian bags dampened with salt water and packaged in a watertight container.

### Skin quality

The relative contribution of the skin to the total slaughter income varies considerably, mainly depending on its quality. It is therefore essential for the producer to ensure that the skin (or ostrich) reaches the abattoir in the best possible condition, taking into consideration all the factors affecting quality.

Skin size, visible skin damage and follicle development determine the price. If a skin does not meet certain minimum standards, its value is reduced, in which case the producer could suffer large financial losses.

Table 10.1 is an indication of the class, grading and price structure currently in use in South Africa – it is adapted regularly in order to satisfy market demands. The relative price differences are indicated relative to a first grade skin of 140 dm<sup>2</sup>, taken as 100:

**Table 10.1** An example of a classification table for ostrich skins, indicating relative prices per unit (dm<sup>2</sup>)

Skin size (dm <sup>2</sup> )	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5
140+	100	65	54	43	21
130-139	98	58	48	40	19
115-129	31	29	27	21	11
50-114	11	10	9	7	4





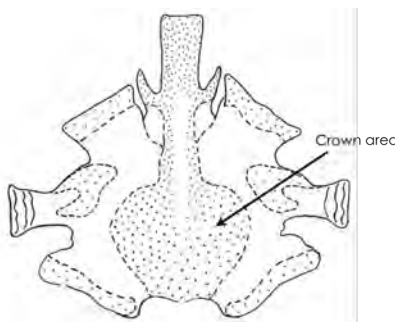
The unit price (per square decimetre) varies significantly according to the size of the skin, with smaller skins fetching lower prices. The unit price also decreases as the skin is downgraded. It is therefore firstly important that the size of the skin is big enough to ensure that the highest price per unit is obtained. Furthermore, skin damage must be avoided to prevent downgrading of skins. Another factor that determines the price but that is not represented here is follicle development. Unacceptable follicle development also affects the unit price.

### *1. Skin size*

Skins are classed according to size. This is done in the processed (or chrome-crusted) phase. Skins with a minimum size of 140 dm<sup>2</sup> reach the highest price per dm<sup>2</sup>, with a decline in price for smaller skins. A slaughter ostrich should weigh at least 95kg before slaughter (live weight on-farm), in order to be reasonably ensured of a processed skin of more than 140 dm<sup>2</sup>.

### *2. Damage*

Next, skins are graded according the amount and distribution of visible damage in the crown area of the skin. The crown area is the diamond-shaped area on the back of the ostrich where the feathers, and thus the follicles occur, as indicated in the accompanying figure 10.1.



**Figure 10.1** Diagram of ostrich skin showing the crown area

The position of damage in the respective quarters of the crown area determines the grading of the skin, because it affects the cutting value of the skin.

Skin damage generally increases with age, with skins from older slaughter ostriches generally obtaining poorer grades. This is probably due to the increasing incidence of aggressive behaviour as ostriches mature, together with the longer period of risk.

Kick marks and scratches are the most important types of skin damage that occur. The sharp toenails of ostriches play a major role. Other types of damage that lead to downgrading are chafe marks, tick and insect bites, feather pecking and sunburn damage. Inflicted damage mostly causes permanent scars that could result in downgrading of skins at slaughter. It is therefore crucial that damage is limited, even from a young age.





Damage to skins can be partially limited by practicing good management and by making use of good facilities. Pay particular attention to the following points:

- Prevent young chicks from being cold at night, climbing on top of each other and trampling one another.
- The toenails of day-old chicks can be clipped to limit damage caused by the toenails during the early stages. The toenails can be clipped short with a de-beaker machine, fitted with an electrically heated blade. This must be done by a trained person to ensure that it is done correctly. The toenails regrow after 2 to 3 months.
- Always handle ostriches carefully to prevent injuries. Noise must be kept to a minimum when ostriches are handled as it induces stress, which can cause the ostriches to become nervous and run into one another or into fences. Use handlers that are familiar with the correct handling methods (constraining and catching methods) to avoid injuries. A minimum of three people is needed to restrain a large ostrich to avoid injuries.
- Use suitable handling and other facilities aimed at the prevention of injuries to ostriches. Sharp corners or anything that could cause injuries (such as sharp protruding edges or wires), should be avoided. Handling pens should preferably be circular so that the birds do not run into corners. Pens can be lined with conveyer belt to prevent chafing or bruising and to prevent the birds from jumping the fences. Floor surfaces should be coarse and slip-proof to prevent birds from falling.
- The fences of ostrich paddocks should be clearly visible to the ostriches to prevent the birds from running into them. White objects can be hung on the fences to make horizontal wires more visible. The provision of lights at night will prevent ostriches from running into fences when disturbed at night time.
- Correct placement and spacing of feed and water troughs are also important.
  - Ensure that there are enough feed troughs to eliminate unnecessary competition around the feed troughs for feeding space.
  - Place round feed troughs far from fences to avoid the birds landing up against the fences when competition does occur.
- Elevate feed troughs from the ground so that the ostriches do not fall over or into them. Keep ostriches at low densities and in big enough camps, considering the number and size of the birds. Densities in feeding paddocks should for





instance not exceed 70-100 ostriches per hectare, to allow sufficient room for them to move around and to prevent the incidence of fall-out chicks and trampling.

- Rotate ostriches regularly between feedlots to counter frustration and boredom. This helps to prevent the development of abnormal behaviour patterns such as feather pecking, which cause skin damage.
- An effective spray or dipping programme against external parasites must be followed to prevent insect and parasite damage. Keep to the prescribed dosages and guidelines for application to ensure efficiency and prevent skin damage.
- When transporting ostriches:
  - There should be enough partitions on the truck to divide ostriches into small groups to prevent trampling.
  - The truck floor should be lined with a coarse fabric to provide sufficient grip and prevent ostriches from slipping and falling.
  - Specially made 'ostrich coats' could be used to protect the birds' skins during shipping. These are strapped around the ostriches' bodies to protect the skins from injury during transportation.
  - Sufficient handlers should accompany the ostriches. Ostriches that are sitting down (sitters) or weak birds should be partitioned off to prevent them from being trampled by the other ostriches.

### *3. Follicle development*

Lastly, skins are also evaluated for follicle development and producers are penalized if it is inadequate. It is therefore important to slaughter the ostriches at a stage when the majority of the skins will be acceptable. Exactly what constitutes acceptable follicle development is debatable, since it is largely subjective. The most important aspects seem to be an acceptable follicle size and a well-rounded follicle shape.

Follicle size generally increases with age, although it cannot be seen as a hard and fast guideline because genotype and other factors also play a role. With regard to the shape of the follicle, it is important not to slaughter ostriches with green feathers (feathers that are not yet ripe), as this leads to tube-like, open follicles. The shape of the follicle also generally improves with age as the skin becomes thicker.

Both follicle size and shape is moderately heritable and should therefore react positively to selection. Direct selection is difficult however seeing as it is difficult to evaluate these traits accurately on the live ostriches.







## Meat

### Meat Production

Ostrich meat has a favourable fatty acid profile, with a low saturated fatty acid content, which makes it a healthy alternative to other red meats. Meat income has thus become an important product of the ostrich.

The meat income from a slaughter ostrich is determined by the carcass weight, which determines the price per kilogram. The price per kilogram is based on cold carcass weight – that is the weight after the removal of the blood, feathers, skin, intestines, organs and fat; and after the carcass had been hung overnight, during which time a further 4% drip or moisture loss occurs.

In ostriches the fat is mostly stored in the abdominal cavity and under the skin. To slaughter fat ostriches is thus uneconomical, as most of the fat is removed before determining the carcass weight. The ostrich therefore has to be fed as economically and effectively as possible to ensure optimal growth, while preventing the ostrich from gaining too much fat.

It is also important to note that meat production could differ between the various ostrich breeds, namely the South African Black (*Struthio camelus domesticus*), Kenyan Redneck (*Struthio camelus massaicus*) and Zimbabwean Blue (*Struthio camelus australis*). The extent of these differences still warrants further research.

### Meat quality

Presently meat quality does not influence producer income directly, as producers are paid purely based on quantity (carcass weight). Various factors can however affect meat quality:

#### Slaughter age

The tenderness of ostrich meat decreases with age. The meat of younger birds also contains less saturated fatty acids than that of older birds and is therefore healthier.

#### Gender

Meat from females usually has a slightly higher percentage of fat than meat from males.

#### Nutrition

Correct feeding practices are important, as the chemical composition of meat, and particularly of fat, are affected by the feed that the ostriches receive. Supplementing rations with high concentrations of fish meal or fish oil will, for example, have a negative effect on the flavour and taste of the meat and fat. The fatty acid composition of the meat also changes with the addition of fatty acids to the diet of the birds, while a shortage in minerals, trace elements and vitamins could trigger the conversion of protein and energy to fat, which results in an excessively fat carcass. Rations high in energy and low in





protein could also lead to excessive fattening (*Refer to Ch. 3: Ostrich nutrition guidelines for more info*).

### **Stress**

Stress conditions prior to slaughter cause deterioration in meat quality due to an increase in pH. This results in dark, firm and dry meat with a reduced shelf life. Careful handling of ostriches prior to slaughter is therefore essential and will also prevent bruising and injuries that results in condemning of meat.

### **Slaughter Stage**

Both skin size and follicle development are largely dependent on age and weight, generally improving with age and increasing weight. Skin damage on the other hand, also increases with age and increasing weight. Skin quality will consequently not necessarily improve with age or increasing weight. The cost of keeping birds for longer periods makes it difficult to determine when to slaughter for maximum profit.

Every producer should calculate the optimal slaughter stage for his/her own circumstances, taking into account prevailing price and cost structures. In the light of on-going fluctuation of conditions, prices and costs, the assistance of an expert could be of great value. A computer model can determine the optimal slaughter stage given the conditions at hand. Presently, in the absence of an accurate method to determine skin quality on live ostriches, slaughter weight is mainly used to determine the slaughter readiness of an ostrich. However, it is important to remember that for a certain slaughter weight, there could be a variation of as much as 25 dm<sup>2</sup> in skin size and up to 10kg in carcass mass. This could be attributed to differences in age, feeding practices or genetic influences. Furthermore, while slaughter weight is a good indicator of both skin size and carcass weight, it is not an accurate indicator of skin quality. Attention should be given to the minimization of skin damage on the farm and during transportation, to prevent downgrading of an otherwise acceptable skin due to physical damage.

For meat production it is more economical to slaughter ostriches as early as possible, as feed conversion decreases substantially with age, to between 10 and 15kg feed perkg weight increase. A producer should thus determine whether it is economical to keep feeding ostriches to attain optimal carcass weight. Costs to produce a heavier bird should be weighed up against the potential increase in income from a heavier carcass. Carcass mass also does not necessarily increase with an increase in live mass – weight could be added as fat rather than meat, if the ration is not fully balanced or correctly formulated. However, attaining optimal skin size is currently more important due to the big differences in unit price between bigger and smaller skins, and due to the big contribution of skin income to total slaughter income.





An additional factor affecting meat production and income is condemnation of the meat. This usually happens due to bruises or diseases. Carcasses of ostriches with serious air sac inflammation could for instance be condemned totally. Such condemnations result in large-scale financial losses, because there will be no meat income at all, while a slaughter fee will still be levied. Bruises sustained during transportation or handling of slaughter ostriches could also lead to large portions of meat being condemned.

It is therefore important to consider all factors in determining the optimal slaughter stage and to take good care of slaughter birds. The optimal stage should be reconsidered regularly as price structures change (costs and remuneration).

### **External parasites**

External parasites are an important factor in slaughter production because they can affect feather, skin and meat income. Refer to the chapter on health for a list of the most important external parasites of ostriches. An effective control programme such as the one described in the section on feathers, should be followed to control parasites and avoid losses.

Products used to control parasites fall into two groups: the pyrethroid group and the formamidine group. Pour-on or wetting agents can be used. Only products registered for use on ostriches should be used. Prescribed dosages from the manufacturer should be adhered to at all times and be administered according to the recommended withdrawal periods before slaughter. It is important to ensure that the indications for mixing of the products be followed carefully to ensure proper mixing and effectiveness. Incorrect application will also impair the effectiveness and could lead to skin damage and residues in slaughter birds. Products may be alternated to prevent resistance to certain active ingredients. Under no circumstances should own mixtures be used, as this could lead to skin damage or other undesired effects.

The whole flock should preferably be treated at the same time to rid the whole farm of parasites. Alternatively the ostriches should be moved to clean, parasite free paddocks after treatment.

Slaughter ostriches are moved to special vegetation-free pre-slaughter isolation camps after treatment with a registered product, for at least 14 days before slaughter. The paddocks are surrounded by a 3 m wide plant-and animal-free zone to ensure that they are not re-infected with ticks after treatment. The paddocks and the surrounding zone should be scraped and cleaned regularly, leaving no grazing to carriers of ticks.

Investigations showed that ticks found on slaughter ostriches, usually climbed onto the birds during the few days before





slaughter, probably during loading or transporting. Loading ramps should therefore be as close as possible to the pre-slaughter isolation camp and any vegetation, stones and faeces should be removed before the ostriches are loaded.

Good management of external parasites will improve the general productivity of the ostriches, and specifically ensure maximum income from the feathers and skins.

### **In Summary:**

For slaughter purposes it is important to evaluate the ostrich as a whole, because it has three main products which determine the slaughter income. The cost structures, together with the relative importance or contribution of the various slaughter products to the slaughter income at any point, will to a large extent determine the most profitable stage for slaughter. At this stage skin size and quality are the most important factors that influence income, with meat contributing less due to bans on the export of fresh meat. Attention should therefore be focussed on attaining optimal feather and skin quality (acceptable nodule development and minimum skin damage), while ensuring that ostriches are slaughtered with a minimum skin size of more than 130 dm<sup>2</sup>.





## 11 | Health Management

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Although free range, the intensification of ostrich farming in the past few decades led to a considerable increase in ostrich numbers on farms. This has resulted in increased pressure on infrastructure, management and systems. Farmers are increasingly pressurized to farm more profitably in a sustainable manner.

The health of a commercial farmer's ostrich flock is an important factor that could influence the profitability of the system. It is thus essential to follow a health programme which will, with the correct implementation, ensure the health and welfare of a farmer's flock and thus optimise profits. The health programme will be determined by the specific production system, i.e. whether only chicks are reared or whether all the production facets are accommodated on the farm.

Factors which could affect the health of an ostrich flock could be divided into three main categories: the animal itself; the management environment; and the disease-causing agent. These categories are dynamic and interdependent and can never be regarded in isolation of each other. To address only one factor, for example, treatment of only the organism that causes redgut enterotoxaemia will not resolve the problem. The other underlying factors also need to be investigated and, if necessary, be addressed.

The next sections will address the health-related aspects which could affect the profitability of commercial systems.

### Types Of Parasites Occurring In Ostriches

#### External parasites

The most important external parasites which could have an economic impact on ostriches include the bont-leg tick (*Hyalomma* spp.), feather shaft mites, feather lice and ostrich flies (Refer to Ch. 10: Slaughter-bird production and product quality for more info). Tables 11.1 to 11.4 describe the characteristics, life cycles and economic impacts of four common external parasites on ostriches.



**Table 11.1 Bont-leg tick - *Hyalomma* spp. (other tick species)**

<b>Characteristics:</b>	The tick has long mouth parts which enables it to affix itself firmly to the host animal. It is a 'hunter' type tick that can walk fast and far. The tick occurs in the drier parts of the country and hides mainly under stones and animal droppings. It occurs mainly after rain during summer.
<b>Life cycle:</b>	Two-host tick-juvenile stages feed on ground birds and small mammals and adult stages on larger mammals and ostriches. Important hosts include other farm animals and wild animals/birds.
<b>Economic impact:</b>	Skin quality and food security.

**Table 11.2 Feather shaft mite - *Gabucinia sculpturata* and *G. bicuadata***

<b>Characteristics:</b>	The mite is approximately 1-2mm in size and brownish-grey in colour. It lives on the underside of the feather shaft in the feather groove of particularly quills and is recognised as a brown velvety deposit in the feather shaft. Damage is done through sucking the gelatine from the green feather shaft, resulting in the incomplete unfolding of the feathers.
<b>Life cycle:</b>	The mite is mainly ostrich-specific and is transmitted through direct contact between infected and clean ostriches. The life cycle from egg to adult lasts about 30 - 40 days.
<b>Economic impact:</b>	Poor development of feathers.

Table 11.3 Feather louse – *Struthiolipeurus struthionis*

<b>Characteristics:</b>	The louse is approximately 3-7mm in size and cream to pale-grey in colour. They do not suck blood but have biting mouth parts that could cause skin irritation. The lice occur among the feathers, move around shrewdly and quickly between feathers and eat the down of the feather.
<b>Life cycle:</b>	The louse completes its whole life cycle on the ostrich and is transmitted by direct contact between infected and uninfected ostriches. Wild birds could possibly also be carriers. Duration of the life cycle (i.e. affixed egg, nymph stage to adult louse) is approximately 3 weeks. The lice can survive for several months on the ostrich, but only 1 week when for instance, they fall off.
<b>Economic impact:</b>	Poor feather quality. The marks on the feathers (holes) should not be confused with stress lines (due to e.g. poor feeding). The latter will occur symmetrically across the feather.

Table 11.4 Ostrich louse-fly – family *Hippoboscidae*, *Struthiobosca struthionis*

<b>Characteristics:</b>	The ostrich fly has sturdy legs with claws and a broad, flat body. It can fly short distances. The parasite is blood-sucking. The fly also has an irritation effect and could cause ostriches to appear restless.
<b>Life cycle:</b>	The female 'lays' a pearl which represents the third-stage larva and which is immediately ready to pupate.
<b>Economic impact:</b>	Irritation, poor leather and feather quality.



### Control

There are various registered dipping and wetting agents for the effective control of external parasites. Consult the nearest cooperative or veterinarian for the correct treatment. It is important to use the product strictly according to the guidelines of the manufacturer. When using wetting agents, budget for approximately 4-6 litres per ostrich. With pour-on products/spraying agents it is better to divide the dosage equally into two – under the wings and on the cloaca.

The next sections will address the health-related aspects which could affect the profitability of commercial systems.

### Internal parasites

Two ostrich-specific worms are of economic importance in ostriches: the ostrich wire worm (*Libyostrongylus douglassii*) (also known as 'rotten stomach') and the ostrich tape worm (*Houttuynia struthionis*). Tables 11.5 and 11.6 describe the characteristics, life cycles, control and economic impacts of two common ostrich internal parasites.

**Table 11.5** Feather louse – *Struthiolipeurus struthionis*

<b>Characteristics:</b>	The very small worm is approximately 5-10mm long and red in colour. It occurs in the proventriculus. The worms cause an irritation of the stomach wall that leads to anaemia and inflammation of the stomach lining. This leads to the typical appearance of 'rotten stomach'. Infestation can be diagnosed by doing regular egg counts in faeces samples and checking the proventriculus at post-mortems.
<b>Life cycle:</b>	The life cycle (egg to maturity) lasts 33 days and the first eggs can be observed in the excrement after 36 days. The larvae hatch within 2-3 days (60 hours) under favourable conditions (i.e. heat and moisture). They migrate up against plants where they are eaten. Eggs survive more than 3 years and larvae more than 9 months, even in times of drought. Infestation occurs mainly during autumn and spring from irrigated pastures but also after good rains. Older, infested birds, infested fields and leaking water-troughs are risk and maintaining sites of this parasite. Chicks of over 4 months are more commonly affected.
<b>Control</b>	Only registered dosing agents should be used as treatment, at the correct dosage.
<b>Economic impact:</b>	Mild to serious inflammation of the stomach wall. Weakening, anaemia, poor doer chicks and mortalities.







**Table 11.6** Large ostrich tape worm - *Houttuynia struthionis*

<b>Characteristics:</b>	The worms settle in the small intestine, where they absorb digested food directly from the intestinal tract. The life cycle is still unknown and may occur either through an intermediate host or a direct cycle. The worm may be up to 1 m (100cm) long, is white to cream-coloured and consists of flat, short body segments. White 'pips' (i.e. the egg laden segments) in faeces are characteristic of this type of infestation and are quite resistant to desiccation. In cases of heavy infestation it could cause irritation and particularly impaction of the intestinal tract.
<b>Life cycle:</b>	Little is known about the life cycle of the ostrich tape worm. The tape worms usually have an indirect cycle which means that the eggs are ingested by an initial host such as ants, flies, earthworms or even soil mites, in which the larvae develop. As soon as these small hosts are eaten by the final host (ostrich), the tape worms develop in the small intestine and the first part of the large intestine. A survival period of up to 11 months has been recorded. Spreading occurs through, among other things, older infested birds, infested pastures, natural pastures and infested feeding paddocks.
<b>Control</b>	Regular observation is necessary to identify the infestation. Only registered dosing agents should be regularly administered at the correct dosage to treat the infestation. To limit the infestation as far as possible, birds are kept in a paddock for 24-36 hours after dosing, before they are let out onto pastures. Feeding paddocks should be scraped clean, while cultivation of fields also helps to reduce infestation.
<b>Economic impact:</b>	The tape worm competes with the ostrich for nutrients and thus it leads to poor growth, weakening and weight loss in the ostrich.

#### **General guidelines for dosing for internal parasites**

- Before dosing: Weigh 5-10 birds in the group and use the heaviest bird for a dose calculation. Take care that the birds are more or less of equal size. Calculate the correct dosage (consult the package/cooperative/veterinarian) and ensure that the syringe is correctly calibrated.
- During dosing: ensure that the dosing agent stays in solution by shaking the container regularly. During dosing





the neck of the ostrich should be kept at a reasonable angle and not parallel to the ground. Also block the windpipe, to prevent some of the dose getting into the bird's air sacs, which could lead to air sac infection or even pneumonia.

- Clashes with other products: Never dose with levimasol-containing compounds (consult the packaging/cooperative/veterinarian) within 7 days after the birds have been dosed or dipped with similar medications. These treatments all affect the same nerves and could lead to paralysis of the bird.
- Incorrect dosages: The application of incorrect dosages lowers the affectivity of the treatment and could also lead to the development of resistance to the product.
- Where suspected worm loads cause problems, faecal analyses could help to confirm the infestations.
- Young birds could graze pastures before older birds. Sheep or cattle could graze the fields ('vacuum cleaners') to reduce wireworm and tape worm infestations, before ostriches are put onto the pastures.

### **Resistance to treatments**

One of the biggest challenges farmers frequently encounter in their de-worming programme is the development of resistance to the treatment used. There are various reasons for the development of resistance to medications and thus only the most common pitfalls will be discussed.

#### ***Alternation between medications***

There are only a few groups of active ingredients for farmers to select from for treatment of wireworms and tape worms. Within each of the groups there are a number of brand names with the same active ingredient. By continuously keeping to the same group, resistance against all the brands in the group is stimulated.

#### ***Price***

There is a tendency to use the cheapest medication that could be effective. This often leads to resistance because the cheapest products come from the same group. Farmers should not only check the price, but also the active ingredient.

#### ***Dosage***

As mentioned above, the use of the treatment at much higher or lower dosages than recommended could cause it to be ineffective and consequently allow the parasite to build up a resistance to the medication. Birds have to be weighed to calculate the correct dosage. One practice is to calculate the dosage based on the mass of the heaviest birds. Classification into uniform groups should prevent the overdosage of smaller birds.





### **Excessive usage**

In most cases birds are de-wormed unnecessarily. For example, birds in feeding paddocks will probably not be infested with wireworm, because they do not forage. It is also pointless to de-worm birds if no worm segments are detected in the faeces in the camp, unless a post-mortem exposes the problem.

### **Summary**

- It is important for the producer to understand the factors of parasite infestation on his farm and work out an appropriate treatment programme. Make use of available knowledge, i.e. the veterinarian, to make the right decisions. Remember – the cheapest medications are not always the most effective.
- Be aware of the active ingredients in the medications and follow usage directions on the package. Alternate between groups of medication and change over to different medications every 6 months.
- New concepts in a holistic approach to management of antihelminthic resistance such as “Refugia”, worm burden tolerance and genetic selection will support older management practises. Lowering the exposure of the ostriches to eggs and larvae by using e.g. cattle or sheep (as ‘vacuum cleaners’) or by the raking and removal of droppings from feeding paddocks, are examples of these.

### **Important Disease-Causing Viruses, Bacteria And Fungi**

Below are the names of the most common organisms which could cause disease conditions in ostriches. The list is incomplete, as there are too many various, potentially harmful organisms to mention here. The organisms below are the most common ones which commercial ostrich farmers will encounter in their farming set-up:

- **Viruses**  
*Paramyxo* virus 1 (Newcastle disease)  
*Infuenza A* virus
- **Bacteria**  
These bacteria are usually opportunistic agents.  
*Clostridium* spp.  
*Pseudomonas* spp.  
*Eschericia coli*  
*Klebsiella* spp.
- **Mycoplasma**  
Ostrich-specific *Mycoplasma*
- **Fungi**  
They can cause direct disease conditions or are associated with mouldy and fungus-contaminated feed.





*Aspergillus* spp.

- **Protozoa**

*Cryptosporidium* spp.

## Most Common Disease Conditions

### Enteritis

Enteritis is a classic problem in young animals or birds kept intensive production systems. There is often confusion with the naming of intestinal lesions such as wireworm and necrotic enteritis. This leads to incorrect diagnosis and consequently the use of the wrong medication or management practices. The various kinds of enteritis are briefly discussed below but must be confirmed by animal health professionals.

**Table 11.7** 'Rooiderm' (*Clostridial enterotoxaemia*)

<b>Agent:</b>	Bacteria - <i>Clostridium perfringens</i>
<b>Transmission:</b>	Natural organism in the intestinal tract.
<b>Occurrence:</b>	Disturbance of normal intestinal microbial population, such as deworming, new feed, richer feed or new pasture. Not contagious. Chicks between 2-6 months age appear to be most vulnerable.
<b>Clinical signs and lesions:</b>	Sudden death of particularly the fattest and healthiest chicks. Necrosis of intestinal mucosae (velvet like pale yellow covering), with the accumulation of a foetid, dirty fluid in the intestines. The carcass decomposes rapidly, especially during summer. The intestines are often filled with large amounts of gas.
<b>Treatment:</b>	Preventative management by vaccinating against the bacteria. Treatment of the symptoms is mostly too late, but antibiotics (containing oxytetracycline or penicillin) could prevent new cases.

Note: Viral infections such as Newcastle disease and Avian influenza (Influenza A), and septic/toxic bacterial infections could cause similar sudden mortalities of healthy chicks. The correct diagnosis by a veterinarian will ensure that the correct treatment is applied.





**Table 11.8** Bloody enteritis (*Coli enteritis*)

<b>Agent:</b>	<i>Escherichia coli</i> , <i>Pseudomonas</i> spp, <i>Salmonella</i> spp.
<b>Transmission:</b>	Contaminated water and environment, contaminated feed, faeces.
<b>Occurrence:</b>	This is a contagious condition. Chicks younger than 2 months, but also typically 3-4 months old, are the most susceptible. enteritis is often triggered by a form of environmental stress, and poor hygien practises,
<b>Clinical signs and lesions:</b>	Chicks develop foul-smelling diarrhoea which is watery and grey to dark green or black in colour. Intestines appear thick, with clear or yellow, slimy to bloody content. Chicks are sick for approximately 1-3 days before they die. Mortalities could comprise as much as 90% of a group.
<b>Treatment:</b>	Prevention through good hygiene (water- and feed quality) and disinfection (see Biosecurity). Treatment should be done very quickly before the whole group is infected. Antibiotics (sulpha, aminoglycoside or quinolone antibiotics) should be used together with supportive treatment.

Note: A correct diagnosis by a veterinarian will facilitate identification of the condition and ensure treatment with the correct type of antibiotic. Purchase only first-grade chicks from a reputable hatchery with proven management records. Insist on laboratory records (the supplier's responsibility) which support the hygiene standard (i.e. microbe counts) of the system (incubators, hatches and water). Take note specifically of stress-related factors which could trigger and worsen the disease (e.g. mouldy food).

Important in the case of enteritis:

- The correct diagnosis will ensure that the correct medication is used. An accurate diagnosis can only be made if the veterinarian or animal laboratory receives suitable and fresh samples to make the diagnosis.
- Treatment with antibiotics should be done with the correct dosage and routine, in order to be effective
- Vaccination against rooiderm/ enterotoxaemia should be done before the risk period, to allow the chicks to build up sufficient resistance before the condition presents. Chicks on lucerne are at greater risk to develop the





condition and should be vaccinated earlier and more often with a third dose. Only healthy chicks develop a resistance. It takes 10-14 days to develop the resistance

- Chicks that already have any infections should not be vaccinated

Keep vaccines chilled at all times. Consult the packaging for the correct storage conditions.

### **Summary**

Respiratory tract infections are, like enteritis, a problem that occurs more often in a specific age group – in this case older chicks, particularly from the age of 4 months. This stage is a stressful period in the life of the young chick due to the transition from the rearing phase (chick house) to the growing-up phase (in the feeding paddock). Factors influencing the presentation of the condition are discussed below.

### ***The animal***

The ostrich has effective defence mechanisms to protect it from infections occurring in the natural habitat. Intensive production systems place a lot more pressure on these mechanisms. Only management can reduce these increased risks.

- The first line of defence is the respiratory system, which is designed to warm up and purify inhaled air. The respiratory tract has special mucous-producing glands with fine hairs (cilia) which trap dust particles and organisms that are sneezed or coughed out by the animal.
- The second line of defence is special cells in the blood, air sacs and lungs that can trap and digest foreign matter, and/or release special chemicals to neutralise and kill organisms.

These defence mechanisms can only be maintained and function effectively in a healthy ostrich. During stressful conditions the body secretes stress chemicals and hormones that have a detrimental effect on its own defence mechanisms.

### ***Environment***

Climate changes, particularly a drastic change in temperature (fluctuation) have a detrimental effect. Cold weather causes the cilia to stiffen and retards the flow of mucous. Feed dust or fine faecal dust (from the ground) thickens the mucous and causes the cilia to cling together in clumps. Milled lucerne feed could for instance be rather dusty if not bound with molasses or oil.

Gas such as ammonia causes necrosis (dying back) of the cilia and mucous-producing cells.

### ***Population density***

Large groups of chicks in a limited inadequate space create stressful conditions. The social and feeding behaviour of chicks could be altered by population numbers. It only takes one sick





chick to infect a large group of chicks. Population numbers that are too high also cause chicks to be exposed too frequently to potentially disease-causing organisms (increased disease loading).

### **Nutrition**

Nutrition can have a considerable effect on the above-mentioned defence mechanisms (*Refer to Ch. 3 Ostrich Nutrition guidelines for more info.*). A deficiency in e.g. vitamin A leads to weakened mucous membranes, which, in turn, lead to easier penetration of the mucosae by organisms that could cause disease. Sufficient vitamin E is important to stabilize the mucous membranes. Energy and protein is needed to maintain resistance to diseases. If chicks are cold, receive watered down rations or eat poorly, they have to mobilize their own energy and protein reserves that are stored in the liver and tissue. The chick's resistance is weakened and the respiratory tract becomes more susceptible to infections. Toxins as well as mycotoxins produced by fungi affect e.g. the chick's liver and thus also lower its resistance.

### **Organisms**

Organisms associated with respiratory tract infections are:

**Viruses:** *Paramyxo virus 1 (Newcastle disease), Influenza A virus*

**Bacteria:** *Pseudomonas spp., E. coli, Klebsiella spp. etc. (usually opportunistic agents)*

**Mycoplasma:** *Ostrich-specific mycoplasma*

**Fungi:** *Apergillus spp.*

### **Measures for air sac infection control and prevention**

#### **Production management**

All chick groups, but especially the newest chicks in the feeding paddock, should be checked daily to identify and address any symptoms of air sac infection or problems as soon as possible.

Correct usage of the appropriate antibiotic is essential to control any respiratory tract infections. Choice of antibiotic should be done according to a correct diagnosis of the disease and the most effective antibiotic which will control it. Organisms can however develop a resistance if the medication is used incorrectly. Early treatment of infections gives much better results. If there is already another additional infection such as *E. coli*, often more expensive medication and antibiotic combinations have to be used for longer periods. Repetitive infections occur frequently

#### **Holistic strategy**

The producer's strategy to limit air sac lesions will only be successful through good management and record keeping. Unfortunately this aspect of farming is often more of a challenge. Veterinary assistance and resources such as regular herd visits and strategic use of antibiotics will strengthen the health programme.



## Skin infection

**Table 11.9** Ostrich pox virus

<b>Transmission:</b>	Biting insects such as mosquitoes and midguts.
<b>Occurrence:</b>	Usually associated with an increase in biting insects as determined by rainfall, climate and temperature.
<b>Clinical signs and lesions:</b>	Scaly and crusty round lesions (3-10mm) on bare (featherless) areas of the skin can worsen considerably with added bacterial infections.
<b>Treatment:</b>	Woundspray containing an antibiotic or a disinfectant such as iodine with a softener (glycerine).

Note: Other skin infections such as fungi do occur sporadically, mostly during wet weather. Nutrient deficiencies such as vitamin A and zinc could cause similar scars to pox, particularly around the eyelids and mouth corners. Plant toxins like 'wild root' (*Apiaceae* family) cause serious skin lesions (sunlight hypersensitivity due to furocoumarine), but chicks recover readily when they are taken off the contaminated pastures and are well cared for.

## Nervous system infections

**Table 11.10** Newcastle virus (*Paramyxo* virus type 1)

<b>Transmission:</b>	droplets from sick fowls (breath and faeces), contaminated equipment, people, chickens and wild birds . .
<b>Occurrence:</b>	Close contact with infected poultry . Young chicks are more susceptible. Generally ostriches are less susceptible than poultry.
<b>Clinical signs and lesions:</b>	Neurological signs such as drunkenness, paralysis and death. Older slaughter birds scratch their heads, cough lightly or have diarrhoea.
<b>Treatment:</b>	Prevention by vaccination of ostriches. Geographical separation of poultry and ostriches. No treatment available.

Note: Chicks with low blood sugar levels (not feeding properly) and chicks with impactions, septic or toxic bacterial infections, could have similar symptoms.





## Avian Influenza

Table 11.11 *Influenza A virus*

<b>Transmission:</b>	Dropletsinfected poultry (breath and oral drops and faeces), contaminated equipment, people, water sources, wild birds and sick ostriches.
<b>Occurrence:</b>	Close contact with infected poultry and ostriches. Young and grower chicks are more susceptible. Ostriches are generally much less susceptible than poultry, but virus sub-type differences may occur.
<b>Clinical signs and lesions:</b>	Green urine, respiratory signs such as coughing and sneezing, and death in young chicks when additional bacterial infections occurring at the same time.
<b>Treatment:</b>	Prevention through biosecurity, e.g. water chlorination. No treatment available.

Note: Other causes of green urine include mouldy feeds, bacterial infections, feeding stoppages and even cold (build-up of green gall salts in the liver which are discharged into the urine).

## Stock Medications

### *Main groups*

Stock medications (antibiotics, dipping and dosing agents) have been developed for specific needs and with a particular purpose. Their functioning differs, although there are a number of main groups, where each product within the group has the same active ingredient or has the same effect.

### *Functioning*

Specific features should be kept in mind in deciding which medication to use. If there are resistant worms in the herd, the alternation of medications with the same active ingredient, e.g. two medications containing fenbendasol, will have no effect on the worms. A penicillin antibiotic kills organisms, but tetracycline antibiotic weakens organisms and relies on the chick's internal resistance and ability to overcome the infection.

### *Dangers*

Resistance is one of the biggest problems with the use of stock medications. Low dosages, too short periods of use, or the wrong choice and usage of a product contribute to poor results. International trading partners increasingly demand that stock medications be provided and administered only by a veterinarian. This trend could in the near future become compulsory for producers of slaughter ostriches for export.





Antibiotic build-up in the tissue (e.g. meat) could occur when the withdrawal period after medication is not observed. These residues are viewed in a very serious light and could affect trade negatively, due to the danger to human health.

### ***Lowered usage***

Improved hygiene and cleaning procedures which form part of a biosecurity programme lessen the need for stock medications. Vaccination programmes could bring relief from infections such as rooiderm/ enterotoxaemia(clostridial enterotoxaemia). Little or no treatment will then be necessary. Good production systems contribute through early detection of risk factors and resolution through slight management changes.

### ***Record keeping and storage***

Local and Internationally more responsibility is placed on the accountable authorities and producers of export products to regulate the usage of stock medications.

Record keeping of purchases, reason for usage and volume used, with balancing at the month-end should be maintained for every flock. This practice is required as part of a good management system (Good agricultural practice or GAP).

Stock medications should be stored separately from toxins and in a lockable room/cupboard/ container. Manufacturers' prescriptions on usage and storage requirements should be adhered to strictly to ensure the efficacy of the product.

## **Biosecurity And Animal Health**

Ostriches naturally come from an environment characterized by relatively low microbial counts and low population densities. Intensification in ostrich farming has led to appreciably higher pressure on the animal to produce optimally under semi-intensive to intensive conditions. The birds are increasingly exposed to more organisms which could negatively affect their total well-being and production. It is thus up to the farmer to manage his/her herd such that this impact is minimized, in order to optimize the overall profitability of the commercial unit.

Biosecurity is starting to play an increasing role in the overall profitability of a commercial farming set-up. The control and requirements (health declarations, residues, human involvement) of international (trans boundary) diseases increase pressure on the producer's biosecurity programme. Presently the effectiveness of stock medications cannot be relied upon exclusively for the effective control of diseases.

### **Definition of biosecurity**

Biosecurity is the protection from exposure to factors that lead to disease, lowered production or mortalities. Biosecurity comprises all the measures needed and employed to limit the spreading of potentially harmful and/or lethal biological organisms. The





purpose is to keep biological organisms that are not yet present, off the farm, so that they will not pose a threat to the health and production performance of the herd. An interesting aspect to consider, is if a potential disease causing organism is detected on the farm. to keep it on the farm preventing spread to other farms and or flocks.

### **Why is biosecurity all of a sudden so important?**

Biosecurity is not a new concept. It has always been important, but receives more priority nowadays because:

- People and more specifically producers of products from production animals are now more aware of diseases that could affect the health of farm animals and also their own health,
- Intensification of production methods coupled with the commercialisation of the ostrich industry,
- Increasing occurrence of contagious animal diseases that are of international importance.

The above-mentioned trends have a significant impact on the consumer's perception with regard to the safety of the food they buy. This fact came clearly to the fore with other species such as BSE in redmeat or *Salmonella* on eggs. In the poultry industry the threat of Avian Influenza in the northern hemisphere and more specifically the Asian countries that are traditionally very dependent on poultry products and exports has resulted in various trade restrictions. It is thus not only important to protect a herd from the importation of new diseases. The onus is also on the farmer to design and implement and monitor management aspects that he has in place for protection. The farmer would also be able to prove that certain diseases are absent from the herd, i.e marketing and maintaining a health status.

### **How do I apply biosecurity on my farm?**

Biosecurity comprises all the measures necessary to avoid diseases coming into healthy herds, e.g. isolation camps for new (quarantine) or sick (hospital) chicks, control over the transfer of chicks, cleaning of paddocks and regular disinfection of water and feed-troughs. Biosecurity is also about dynamic herd management that includes management practices to keep and maintain chicks' resistance high. This is by, among other things, reducing social and environmental stressors and the correct feeding practices with balanced feeds according to the chicks' needs (*refer to Ch. 12: Biosecurity in practice*)

Ostriches, from chicks to breeding birds, have specific behavioural needs and if these needs are not accommodated in an intensive commercial system, it could impair the well-being, health and production of the birds.

Elevated stress levels, lead to suppression of the herd's production. The most important factors to be managed in





order to keep stress levels as low as possible, include, among other things, feed (quality and adaptation period; *Ch.3: Ostrich Nutrition guidelines*), water (quality and provision), housing (density, ventilation, temperature; *Ch. 9: The housing of ostrich chicks*), population density (feeding paddock, breeding paddock), environment (wind, temperature, noise), routine (especially important with chicks) and handling (*Refer to Ch. 8: Artificial rearing of chicks for more info*).

### **How do I set up my biosecurity programme?**

The setting up of a biosecurity programme comprises the determination of the health risk status of the particular farm and the drawing up of a programme to minimize the spread of existing and potential new organisms.

### **Risk determination**

The first step in biosecurity is to determine, with the assistance of a veterinarian, the type and level of risk to which an individual production unit is or will be exposed to. There are many factors determining the risk level – risk level is also peculiar to each type of production unit and animal, as well as the management skills of the owner and/or manager (i.e. the probability it will occur).

For example, the type of animals (age, sex, race, etc.) farmed and the production system used should be described. Additional information such as current animal health problems and performance could also be used. Table 11.12 is an example of a simple farm evaluation.



Table 11.12 Biosecurity evaluation –Farm Kamanassie

<b>Magisterial district:</b>	Oudtshoorn
<b>Species:</b>	Ostrich (main), sheep, cattle
<b>Races:</b>	Oudtshoorn ostrich, Dorper, cross-breed Hereford
<b>Stud or commercial:</b>	Commercial
<b>Number of animals:</b>	[120 breeding birds, 740 slaughter birds (4-15 months)]
Sheep	24
Cattle	12
<b>Production system:</b>	Breeding birds (natural veld + full feeding), egg production/incubation (self), chick rearing (lucerne pasture + full feeding), slaughter bird preparation (full feeding in feeding paddocks) and slaughter. The rest of the livestock on lucerne pasture after ostriches have been on it.
<b>Environment:</b>	Little Karoo, dry, winter rainfall, flood irrigation of lucerne, feeding paddocks, natural veld.
<b>Closed unit?</b>	Ostriches – yes Sheep – Only the ram is replaced every 2nd year (within district) Cattle– Bulls replaced every 4 years
<b>Status of farm fencing:</b>	Veld: Good but from time to time neighbouring males do come through. Inner fences: very good.
<b>Other animals on the farm:</b>	poultry and pigeons at neighbouring farm workers houses.
<b>Health problems [Health plan management]</b>	Internal parasites: Round worms and Tape worm. External parasites: Bont-leg tick Infection diseases: rooiderm/ Enterotoxaemia, Diarrhoea and air sacculitis Other: Newcastle disease, Avian Influenza – not on farm but strategically important disease for export.
<b>Production performance:</b>	Eggs/female-60, Chicks/female-22, slaughter birds/female-8, Slaughter mass-95kg, slaughter age 13 months, carcass mass 42.5kg, Skins 1st-2.3%, 2nd-3.5%, 3rd& 4th-4.2%.
<b>Other problems:</b>	Low hatching percentage with early embryo deaths Seasonal air sacculitis occurrence (autumn/ spring)



With the above background a list of potentially dangerous diseases is compiled (from highest to lowest priority) and for each of the diseases it is determined:

- How big is the risk of exposure to the herd/farm,
- What is the potential impact of the disease,
- What could be done to lessen or eliminate the risk.

The health plan should be compiled in cooperation with the local veterinarian, because he/she knows about the disease in the district and also at a national level. Once the potential for the occurrence and scope of the impact of specific diseases are determined, the necessary steps of action which could limit the risk of bringing the diseases onto the farm can be defined.

The tables below provide examples of potential strategic- and production diseases (i.e. direct disease and mortality influence). Be aware that these lists only provide examples and do not represent the total number of diseases which could affect the ostrich.

#### **Diseases that pose a risk:**

Strategic diseases which could affect the well-being and health of ostriches:

PARAMETER	INFORMATION AND/OR DECISION
<b>Newcastle disease</b>	
<b>Risk level</b>	Medium to high
<b>Potential impact</b>	Very large influence on export status of farm. Farm will be placed under state-controlled quarantine until the herd is declared clean.
<b>Action</b>	Vaccinate chicks, breeding and slaughter birds according to a programme. Prohibit purchasing/bringing in of live poultry. Train workers to report any signs of abnormal poultry deaths. Apply strict entry control (strange workers or visitors are not allowed to move among birds). Chlorinate all water sources and make feed and water-troughs wild bird-unfriendly.





PARAMETER	INFORMATION AND/OR DECISION
<b>Avian influenza</b>	
<b>Risk level</b>	Medium to low
<b>Potential impact</b>	Very large influence on export status of farm – Farm will be placed under state-controlled quarantine.
<b>Action</b>	Prohibit purchasing/bringing in of live poultry. Train workers to report any signs of abnormal poultry immediately. Apply strict entry control (strange workers or visitors are not allowed to move among birds). Chlorinate all water sources and make feed and water-troughs wild bird-unfriendly

Production diseases that could influence the well-being and health of ostriches:

PARAMETER	INFORMATION AND/OR DECISION
<b>Enteritis (<i>E. coli</i>)</b>	
<b>Risk level</b>	Medium to high in chick group.
<b>Potential impact</b>	Moderate to high sporadic deaths (15-75%) and retarded growth due to damage of the intestinal tract.
<b>Action</b>	Establish good intestinal bacteria and apply appropriate hygiene management of water-and feed-troughs. Employ workers with sole responsibility for the care of the young chicks. Avoid the use of mouldy or poor quality feed. Train workers in basic personal and environmental hygiene.

The basic facets of a biosecurity programme will comprise the following components:

#### *Certification of health status*

The first decision will always be to buy animals from a source with a proven health record, i.e. of which the health status is known or even certified by a veterinarian. In a closed system the health status of the system (veterinarian involvement, monitoring of strategic diseases) will have to be proven regularly on an ongoing basis.





### *Quarantine*

The most basic principle in biosecurity is the isolation of newly purchased or sick animals for a period of observation and/or treatment before they are mixed with the rest of the herd. The quarantine area should not be accessible to the birds not of the core flock. People working with the quarantined animals should also not work with animals in the core flock before their boots and clothes are disinfected. A practical example is the blood monitoring of newly-bought slaughter birds resistant organisms from being transmitted to the existing herd on the farm. Newly purchased animals are currently the most important sources for the spread of resistant worms throughout the country.

### *Elevation of resistance*

In many cases it is not practically possible to keep diseases off the farm, because it is difficult to determine whether an ostrich is a carrier of a certain disease. In some instances the biological organisms are spread by wild birds (e.g. Avian influenza, Newcastle disease), over which there is little control. Good management practices (i.e. feeding, handling, etc.) and the use of vaccines are basic methods to elevate resistance in ostriches.

### *Access control*

People, feed, water and vehicles could spread organisms with equal ease. An example is workers who buy/bring in poultry (e.g. old layer hens) and with them after visit distant relatives. The poultry most probably have viral diseases like Newcastle disease.

### *Sanitation*

Disinfection of instruments, shoes and cleaning equipment is very important, particularly in the more intensive sections, such as in the chick section, but also at feed and water-troughs of the breeding and slaughter birds. The basic rule to follow is remove organic material, wash with a soap, use the disinfectant and leave to work. There are large differences in the efficiency of the various cleaning agents. Consult the local veterinarian and sales representatives on the correct choice of disinfectant to address the problems on the farm.

### *Communication*

With the free movement of animals and rapid spread of certain diseases, it is essential to establish an efficient communication network between veterinarians and producers. Such a network could provide an opportunity to farmers and veterinarians to report the occurrence of diseases easily, and to process the reported trends so that all producers could be alerted by their veterinarians with regard to a disease warning and/or the control thereof.

### **In conclusion:**

- Biosecurity is a simple concept geared to limit the spread of potentially harmful biological organisms. For







the farmer it is important to compile a health management programme for every production unit, with the cooperation of the local veterinarian.

- The importance of a biosecurity programme and the implementation thereof cannot be over-emphasized. The biosecurity programme could initially be simple and then methodically extended until all production units are included.
- Perhaps one of the most important components of a biosecurity programme is the interactive communication (i.e. regular farm visits, post-mortems, monitoring of diseases) between producer and veterinarian. This will keep the producer informed so that he could implement the best and most appropriate measures.
- Participation in the compilation and implementation of biosecurity on a local and national level requires the active and dynamic participation of all the concerned parties. Only then can the application of biosecurity take place effectively. Thus, if biosecurity cannot be applied effectively at a national level by the Department of Agriculture: State Veterinary Services – through import requirements, quarantine, and access control at harbours and airports – it will increase the risk and place more pressure on the individual producer to apply these measures at farm level.

### **Welfare**

An aspect to which producers must be acutely aware of is animal welfare. There are 5 freedoms to which any producers will be measured when determining his responsibility towards his ostriches. They are:

- Freedom from hunger and thirst
- Freedom from discomfort
- Freedom from pain and suffering
- Freedom from stress
- Freedom to express normal behaviour

These freedoms not only is a welfare concern but is a basic requirement for ensuring accountable production which has a direct influence on the farming business' sustainability.

The ostrich industry and its producers are leaders in this regard and must maintain their high level of responsibility and accountability.





## 12 | Biosecurity In Practice

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### Introduction

*Biosecurity is the cheapest, most effective means of disease control available and refers to those measures taken to keep disease out of populations, herds, or groups of animals where they do not already exist. Good biosecurity should be practised at all times not only during a disease outbreak. The responsibility for farm-level biosecurity belongs to the producer or flock owner.*

A wealth of general information with regards to biosecurity measures for poultry is available in the literature. Although there might be no specific reference with regards to biosecurity measures for ostriches, the principles are actually the same for all species and production systems. The only difference is that biosecurity measures for some species might be more elaborate than others.

All biosecurity measures pertaining to ostrich production in South Africa are set out in a Veterinary Procedural Notice (VPN).

*VPN/04/2012-01 (Revision 6.0) - Standard for the requirements, registration, maintenance of registration and official control of Ostrich compartments in South Africa is currently (2014) applicable.*

In addition to those measures, general biosecurity measures applied by the Poultry industry could also be adopted to assist the producer in keeping his/her ostriches healthy.

Diseases are spread in many different ways: by direct bird to bird contact; by people carrying pathogens on clothing, hands or footwear from one camp/compartment to another; contaminated equipment going from one place to another; vehicles, animals, etc. In this chapter reference will be made to the major routes for disease and pathogen transmission as well as biosecurity measures that can be applied.

### Major routes for disease and pathogen transmission *Ostriches*

- “new” birds (transfer of birds from production area to production area)
- multiple age ostriches raised together
- infected eggs
- sick birds
- dead birds (disposal of carcasses)
- animal waste (practice good waste management)





### ***Other animals***

- wild birds
- domestic birds or other poultry species
- feral and domestic animals, including other livestock and pets
- insects
- rodents – rats/mice

### ***People***

### ***Facilities***

- Compartment (access control)
- Isolation camps (pre/post movement camps)
- Handling facilities
- Hatchery (sanitation)
- Chick-rearing facilities (sanitation)

### ***Equipment***

### ***Vehicles***

### ***Air***

### ***Water supply***

### ***Feed***

## **Ostriches**

### ***“New” ostriches/the transfer of ostriches from production area to production area***

Bringing in “new” ostriches onto your compartment usually presents the greatest risk since these birds’ disease status is unknown. Producers should therefore purchase ostriches from sources with known health status. In addition, a producer should isolate all “new” ostriches before they can be integrated with the existing ostriches on his/her compartment. During this isolation period there may be no over the fence contact between the “new” ostriches and any other ostriches on the compartment. A Veterinarian can perform various tests during this isolation period.

“New” birds might have intestinal worms or external parasites like mites or lice on their feathers. A risk analysis, taking into account various factors specific to your area, your farm and your management system will determine how the treatment of the “new” ostriches should be approached.

The “new” ostriches should also be observed daily for signs of diarrhoea, reduced feed intake, weight loss, or breathing difficulty. The risk of spreading infectious agents to your farm is highly increased if “new” ostriches are frequently introduced. Every bird that has been off your compartment should be considered as a suspect carrier of disease.

The “new” ostriches may also be very susceptible to an infection that is already present in the ostriches that appear





normal on your farm. Ostriches that have seemingly recovered from a disease can still be carriers of that specific disease. These “carriers” can pose a threat to the rest of the flock and especially to the “new” ostriches. Therefore as an extra preventative measure, after adding the “new” ostriches to a flock, observe that flock for at least 4 weeks for any sign of symptoms of disease.

### ***Raising multiple ages together***

Preventing the introduction and spread of disease is easier if one divides an ostrich compartment into physically separated functional units. This could easily be done by separating ostriches by age group. Minimise movement between age groups/functional units.

Typical functional units might include:

- *Breeder farm/unit (could include the hatchery)* - This unit includes all facilities that houses breeding animals and in many cases could also include the hatchery. The biggest investment on an ostrich compartment is in the breeding stock and disease prevention is critical here. If at all possible, a dedicated team should be responsible for the breeder unit and other personnel should be responsible for the rest of the farm. If, as one functional unit the hatchery is part of the breeder unit, the team responsible for the breeder birds would then also be involved in the gathering of the eggs and the monitoring of the machines in the hatchery. It is far safer for ostrich operations to make use of a “closed system” (produce their own hatching eggs and hatch them in their own incubators), than to buy in eggs or chicks.
- *Hatchery (if hatchery only)* - With this farming unit eggs are normally purchased from various producers, incubated, hatched and then sold or are incubated and hatched on contract for some producers. It is important to buy only from producers who can document good fertility, hatchability, and survivability of their chicks. Purchasing fertile eggs and mixing eggs of many sources in an incubator can be very risky. One diseased egg in an incubator can threaten the health of all the others.
- *Chick-rearing unit* - breeding stock should be separated from offspring. The chick-rearing unit includes all young chicks from one day to age 3 months. This age group often suffers the highest death loss and their care is more labour intensive. Day-old chicks should be delivered to the chick-rearing unit either in new containers or in clean, disinfected containers.
- *Grow-out unit* - the grow-out unit would then comprise of birds older than 3 months until market or slaughter age. Ostriches might either be slaughtered at an export





abattoir or at an abattoir that delivers to the local market. Care should be taken that all biosecurity measures for slaughter birds, as determined by the industry at that stage, should be followed.

### ***Infected eggs***

One diseased egg, can threaten the health of the entire group of eggs, in an incubator. Therefore buy only from people who can document good fertility, hatchability, and survivability of their chicks. It is far safer for ostrich operations to produce their own hatching eggs and to hatch them in their own incubators.

### ***Contact with sick birds***

Pathogens can be spread in direct bird to bird contact through secretions and faecal material. Isolate sick ostriches from the remainder of the flock. Sick ostriches should be subjected to clinical examination as well as any relevant test in order to make an accurate and prompt diagnosis. Personnel responsible for taking care of the sick birds should only work with them after they had finished their tasks at the healthy birds and preferably as the last task of the day.

### ***Contact with dead ostriches (disposal of carcasses)***

Dead birds should be removed from ostrich rearing facilities and camps as quickly as possible but at least daily. All dead ostriches, where the cause of death is unknown, should be assumed to be infective and handled appropriately to ensure that pathogens are not spread to other ostriches on your unit/compartiment or to other farms. Dead ostriches should be subjected to post-mortem examination in order to make an accurate and prompt diagnosis of the cause of death. All deaths as well as the cause of death should be recorded.

Carcasses should be transported and disposed of in a safe and effective manner making use of only appropriate and approved methods at approved sites where there is no risk of polluting waterways. Most pathogens can survive for considerable amounts of time in a carcass. Rodents, flies and other scavengers with access to carcasses can carry pathogens over considerable distances to neighbouring farms or other areas of your farm. It is therefore very important that all body parts are completely covered with at least 400mm of soil and that a layer of chalk is added on top. This will ensure that earthworms do not carry pathogens to the surface. Add extra soil on top to ensure containment of any possible disease agent in the carcass. At no stage may dead ostriches be disposed of in a manner that might expose them to, or pose a threat to other animals.

Please note that in case of an outbreak of Avian Influenza or any other notifiable disease, methods of disposal as prescribed by the Provincial State Veterinarian, or as prescribed by other legislation applicable to the disposal of dead animals, will apply.





### ***Contact with waste coming from ostriches (practice good waste management)***

Pathogens can be spread through the faeces of infected birds. When an ostrich rearing facility is cleared of a batch of ostriches or depopulated, it is recommended that all faeces and litter be removed from the facility and then transported and disposed of in a safe manner. This practice will minimise the risk of the spreading of pathogens from one flock to the next.

All damaged eggs, dead-in-shell embryos, hatchery waste and garbage should be removed from the hatchery and its environment as soon as possible and contained (a big plastic drum with lid could be used). Dispose of it promptly and properly by burial.

### **Other animals**

#### ***Contact with wild birds***

Ostriches are exposed to potential Avian Influenza carriers since they are farmed in open areas, making it almost impossible to isolate them from other avian species. Wild water birds can be carriers of Avian Influenza and should therefore be discouraged from having contact with your ostriches. There are a few steps that can be followed to prevent or reduce the spread of this virus:

- Ostriches should not be kept in camps where there are open pans or vleis areas. Such an area should be properly fenced off to prevent access by ostriches.
- Move or locate new facilities away from ponds and waterways used by migratory fowl, such as ducks and geese. This is to minimise direct contact between ostriches and wild water birds or faeces of wild water birds.
- Feed and water ostriches in specially designed troughs that prevent easy access by wild water birds.

Chick-rearing facilities and other buildings used by ostrich producers are popular nesting places for small birds, such as sparrows and starlings. Discourage wild birds from establishing nesting areas in these facilities by removing any nesting material as soon as it is noticed. Prevent wild birds from entering chick-rearing facilities and buildings such as your feed store, by closing easy access openings. Even though it might be very tempting to feed wild birds on the premises, don't actively feed wild birds or dispose of old feed in such a way that wild birds are drawn to your facility. Wild birds could be carriers of pathogens such as *Salmonella* sp.

#### ***Contact with domestic birds***

Poultry in particular can spread many diseases to your ostriches.





*Definition of poultry according to World Organisation for Animal Health (OIE's) Terrestrial Animal Health Code and the Animal Diseases Act, 1984 (Act. No 35 of 1984). "It includes all domesticated bird species amongst others pigeons, ducks, geese, fowl, turkeys, Muscovy ducks, domesticated ostriches, tamed wild birds and birds kept in captivity, but excluding individual caged pet birds that are kept in a private house".*

These diseases may affect your farm. Workers should therefore be prohibited from keeping their own poultry, either at dwellings on the farm itself or at houses away from the farm. Ostriches are susceptible to diseases such as pox, Newcastle disease and possibly other diseases of poultry.

#### ***Feral and domestic animals, including other livestock and pets***

Animals, other than ostriches of the appropriate age, should not be permitted access to ostrich rearing facilities. Always consider the potential risk posed by other animal species. Salmonellosis has been reported to be transmitted to ratites from pigs, goats and poultry.

#### ***Insects***

Flies, blowflies and other Arthropods are reservoirs and vectors of a wide variety of pathogenic organisms affecting poultry. Moist manure in chick-rearing facilities presents an ideal habitat for the development of large populations of the house fly and related species of flies that can be found in manure. Fly breeding should be controlled to the minimum, either by regularly cleaning out the chick-rearing facility or by applying a registered product to dry out the manure.

Blowflies also lay their eggs on protein rich media such as animal carcasses and broken eggs. Under optimal environmental conditions blowfly larvae can develop to robust adults in less than a week. To prevent this from happening, dispose of dead birds and broken eggs promptly and in such a way that all material disposed of is properly covered with a layer of soil.

#### ***Rodents-rats/mice***

It is conceded that the control of rodents might be more difficult in a farming environment. However as to prevent rodents from establishing in ostrich camps, make use of raised feed troughs or move feed troughs regularly as to discourage rodents from nesting underneath the feed troughs. Furthermore try and discourage rodents as far as possible from entering your hatchery; chick-rearing facilities, stores, etc. by keeping areas around the buildings free from unwanted vegetation and debris that could attract or harbour pests. Control rodents by maintaining baited poison stations. If possible store feed in rodent-proof containers as rodent droppings can harbour disease-causing organisms. Rats can be carriers of pathogens such as *Salmonella*.





## **People**

Disease can be spread on shoes, clothing and hands of people who move from flock to flock, unit to unit or farm to farm. Access to a compartment/unit on your farm should be controlled to ensure that only authorised persons and vehicles enter the site. All production area personnel and visitors entering an ostrich production unit or compartment should follow the biosecurity requirements as set out for that unit or compartment. These requirements would be based on the risk assessment as determined by the producer with assistance from his Veterinarian.

It is conceded that visitors from urban areas or visitors who have no livestock contact, present very little risk of introducing disease or pathogens to your ostrich compartment. On the other hand, neighbours, Veterinarians, contract vaccinators and people coming in contact with ostriches or other poultry species should be considered high risk visitors. As a general management practice, restrict the number of visits to your farm as far as possible.

With regards to sanitation the preferred procedure is for production area personnel and visitors to change into clean clothes and footwear. Clean overalls and clean footwear should be provided. Production area personnel must wear laundered clean clothes each day before commencing with their day's work. Overalls and footwear should not be shared between one unit and the next. Separate clothing should be provided at each production unit and should after use be contained e.g. in a plastic drum with a lid, until it can be washed.

Many pathogens remain viable in soil for long periods of time. These pathogens can be transferred from unit to unit or farm to farm on footwear. Footbaths may help to decrease the dose of organisms on footwear. Production area personnel and visitors can either use a properly maintained disinfectant footbath or a boot spray. Footwear should be disinfected before entering a unit and at all demarcated areas in a production unit.

Beware that an improperly managed foot bath may become a source of infection. Change the disinfectant solution in the footbath on a regular basis to ensure efficacy. The disinfectant's dosage, whether in a hand spray or in the foot bath, should be according to the manufacturer's recommendations.

All production area personnel and visitors should on entering a unit as well as on leaving the unit, wash their hands with soap and water or sanitize them using a disinfectant.

It would be best, if dedicated production area personnel could be appointed to be responsible for a specific age group. However, it is not always feasible to have dedicated personnel for each age group in a farming environment. Therefore if you have







limited personnel available, it is of utmost importance that, on a daily basis, production area personnel visit the most valuable birds first, then the ones that are not as valuable, then the ostriches in the pre-post movement isolation camps and lastly the sick birds. Movement between these groups should however not be done without a change in overalls and shoes and before hands and shoes were properly disinfected. Always wash and disinfect your hands after handling birds in isolation or sick birds.

Be a good neighbour. Stay away from other ostrich and poultry farms.

## **Facilities**

### ***Compartment***

Ostrich compartments should be fenced in a way that will prevent predators as well as undesired visitors from entering the farm. All access gates to the compartment and facilities must be locked when possible.

Post warning signs at main entrance to the ostrich compartment that indicate your concern for diseases. Access control must be implemented. An access control register must be kept that at least contains the following information:

- Date of the visit
- Name of the visitor
- Telephone number
- Reason for the visit
- Visitor declaration (I have been on another ostrich/poultry farm within the past 3 days – Yes/No)

### ***Isolation camps (defined as Pre-/Post movement holding camps by the VPN)***

According to the VPN specific camps need to be set aside where “new” ostriches, moved from one compartment to another, can be placed for an observation and testing period. During this isolation period there may be no over the fence contact between these ostriches and other ostriches on your farm. Ideally, these camps should be a good distance away from the rest of the units.

### ***Handling facilities***

Be aware that the ostrich handling facility on your production unit/compartment could be a source of infection as both “new” ostriches coming onto that unit/compartment and existing ostriches being moved from that unit/compartment make use of the same facility. A basic procedure of cleaning, i.e. removing of organic material, and disinfecting is a good practice.

### ***Hatchery***

The design of the hatchery should take account of work flow and air circulation needs, with “one way flow” movement of eggs and day-old chicks and one way air flow in the same direction. The floor of the hatchery should be constructed of concrete or





other impervious materials and be of such a design that it could be cleaned and disinfected effectively. Establish an area free of vegetation around buildings to discourage rodent and insect traffic into the buildings. Plan periodic clean-out, clean-up, and sanitation of facilities and equipment in the hatchery.

### ***Chick-rearing unit***

Pens (in buildings) - Place new batches of chicks only in facilities which you know have been cleansed **and** disinfected. Cleaning **and** disinfecting is one of the pillars of biosecurity. When ostrich chicks in a pen are old enough to be moved to larger pens/runs, move all the chicks at the same time (all-in- all-out policy). This allows pens to periodically become empty, and ready for thorough clean-out and disinfection. This procedure not only allows for a break in disease cycle, but it is frequently observed that overall bird quality improves if a chick-rearing facility can stay empty for a while. Many registered disinfectants are available for use in livestock buildings that are very effective. However, all require that organic material (manure, feed, feathers, etc.) first be removed before disinfection should take place.

Before populating a chick-rearing facility with a follow-up batch of chicks, follow these steps:

Clean the building:

1. Remove all old feed and manure
2. Sweep out loose dirt, cobwebs, feathers, etc.
3. Scrub all surfaces with a detergent
4. Rinse all detergent and organic matter from surfaces (a steam or high-pressure water hose may be helpful for steps 3 and 4.

Then sanitise the building:

5. Apply the disinfectant
6. Let the disinfectant dry completely
7. Then reapply the disinfectant and again allow it to dry.

Use the method above to clean and disinfect all water and feeding equipment. Only make use of detergents and disinfectants registered for this purpose. Also remember to flush out all water pipes and clean out all filters.

The zone immediately around the chick-rearing unit (building) must be kept clear of vegetation and rubbish, and should ideally be covered by concrete or a similar material for easy cleaning.

Soil contamination is a major area for contamination build-up therefore ostrich runs (outside areas used for rearing ostrich chicks) should be left clear for a minimum of 30 days between batches to allow the sun time to kill the bacteria build up.

### **Equipment**

Pathogens can be transferred on farm equipment that is being





shared between units. Any equipment leaving the unit should be cleaned and disinfected prior to being returned to the unit. It is preferable that each unit should have dedicated equipment.

Containers used for the transportation of chicks should be cleaned and disinfected between each use.

### **Vehicles**

Provide a dedicated parking area, isolated from the remainder of the farm, for visitors.

Vehicles transporting feed pose a serious risk to your ostriches by their potential to transfer pathogens from area to area on their wheels and chassis. It is therefore a good management practice to store bulk feed supplies as far as possible from the ostrich premises to eliminate the need for feed delivery vehicles to enter the area where ostriches are kept.

In a farming environment it is often found that vehicles have a multi-purpose use. Consider the risk of spreading a pathogen when using such a vehicle. Any vehicle entering a production unit/compartment should be cleaned and disinfected according to a standard operating procedure as determined by that unit/compartment. Vehicles used for the disposal of dead ostriches must be properly cleaned and disinfected before using it for anything else.

Transportation of ostriches should be done in vehicles especially adapted for this purpose. Vehicles/trucks should be cleaned, and disinfected before loading each consignment of eggs, chick or ostriches.

### **Air**

Many of the important infectious diseases are air-borne transmitted, and the possibility of infection increases in direct correlation with the density of livestock in the surrounding area. The location and design of an ostrich farm and the proximity to poultry farms, other ostrich farms, processing plants and mines is amongst the most important points in a risk assessment and will affect biosecurity measures for that specific compartment. Biosecurity measures for ostrich farms located adjacent to public roads where there is significant traffic of poultry or poultry house litter will also be stricter due to the higher risk of the transfer of pathogens. Small particles of contaminated material can be carried by the wind into the farms. When laying out a farm, ensure adequate protection against the wind. Chicks are very prone to contracting disease therefore minimise the risk by not housing chicks downwind from older birds.

### **Water supply**

Ensure that your ostriches don't have access to potentially contaminated water, such as surface drainage water or standing water. Always supply your ostriches with clean, fresh drinking water. The water supply should fulfil the requirements for





drinking water quality for livestock. Drinking water should be disinfected with a suitable disinfectant to inactivate any possible Influenza Virus without harming the ostriches. Water troughs should be cleaned and disinfected on a weekly basis. This is to prevent build-up of possible disease causing organisms

### **Feed**

Feed may be contaminated by the raw materials used, post-production and during transport, or by exposure to rodents and birds on the property.

Buy commercial feed only from an officially registered feed mill. Store newly delivered batch of feed separate from the old batch and keep all documents accompanying a batch of feed for traceability purposes. Feed must be stored in clean and sealed containers (silos or bags). Make sure your feed store is free of vermin (e.g. rodents, insects, etc.) and that there is no access for wild birds. Bacteria and mould in poor quality or damaged feed may also be of concern. Bulk feed supplies should be located as far as possible from the animal premises to eliminate the need for feed vehicles to enter the area where ostriches are kept.

Food provided to ostriches/ratites in open pens is very attractive to wild birds. Feed ostriches in specially designed troughs or troughs lifted from the ground to discourage visitation by wild water birds. Feed spillage should be reduced as much as possible. Supply feed regularly and in just sufficient amounts as to ensure no feed is left over that can attract wild birds unnecessarily.

### **Recordkeeping**

With regards to biosecurity it is very important to keep record of all actions on the farm. With this information producers will be able to evaluate existing biosecurity measures and its risk mitigating effects. New risks can develop which can either then be addressed by existing measures or new measure need to be developed.

### **Conclusion**

Disease can result in devastating losses regardless of the size of your compartment. Diseases are far easier and more economical to prevent than to treat. On-farm biosecurity will only work if everybody on the farm is trained in, and totally committed to applying all biosecurity measures.

Please remember the following: *“The monitoring of ostrich health on the ostrich compartment should be under the supervision of a Veterinarian. It is essential that all ostrich farmers and their Veterinarians liaise closely with their respective State Veterinarians. Transparency is essential and any outbreak of disease, or suspected outbreak of disease has to, according to the Animal Diseases Act (Act 35 of 1984), be reported to the*





*State Veterinary Services. This will ensure that the presence and nature of the disease is established without delay and necessary measures can be instituted by the veterinary authority to control losses and prevent the potential spread of the disease”.*

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# 13 | Economic Viability And Financial Management

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## Introduction

Financial management is but one of the many important functions of business management and should be integrated carefully with, among other things, production management, marketing management, administration and other facets of management. The financial position of any business is usually the end result of the production and marketing decisions made in the business. Short-term production and operational decisions affect the annual profits directly, whereas marketing and strategic management decisions influence the ultimate survival, growth and financial position of the business over the long term. Because price structuring and marketing in the ostrich industry are mainly determined downstream in the value chain, the typical ostrich farmer is a price receiver – as an individual he has little room to influence prices and markets. It is therefore important for the producer to focus on those aspects of the business that can be controlled and managed – among other things, production efficiency and financial performance. This chapter therefore focuses on those aspects that the entrepreneur can manage and illustrates the potential margins that could be realised with various production and management systems. In instances where low or negative margins are portrayed, it is imperative that current production practices and existing price and market structures be scrutinized.

## Description Of The Methodology For Economic Analyses

A practical and simple method to determine the potential profitability of a single enterprise within a business is the calculation of 'margin above cost' for the enterprise. The margin above cost is calculated by determining the gross production value (GPV) of the enterprise, minus the directly allocable costs (DAC) of the enterprise. GPV of a livestock enterprise is usually generated from three sources: production income (annual sales of products), trading income (annual sales of livestock minus





purchases of livestock) and capital income (increase or decrease in value of the herd within the production year). DAC are costs directly allocable to the enterprise's production process and exclude costs that are difficult to directly allocate to the specific enterprise or that are shared with other enterprises on the farm (so-called overhead costs, e.g. electricity, labour, fuel, etc.). Margin above cost (gross margin) is thus a measure of the profitability of a particular single enterprise, but not of the whole farm. As margins depend on changes in product prices and input costs, as well as yields and input quantities, such potential changes and the influence thereof on the margins should be taken into account in calculations. This can be done through sensitivity analyses.

## Economic Viability Of The Most Common Production Systems

From the previous chapters it is clear that there are various ostrich production systems, with considerable variation within each system. To illustrate the economic viability of ostrich farming, five common, representative systems, typically found in the Little Karoo and Southern Cape, will be presented, namely:

1. the breeding bird system for the production of day-old chicks;
2. the intensive rearing of chicks from day-old to 4-months of age;
3. the intensive system of growing out and rounding off birds in feeding paddocks from 4-months of age until slaughter at two alternative ages (10 and 12 months);
4. the full system of rearing, growing out and rounding off birds in feeding paddocks from day-old until slaughter at two alternative ages (10 and 12 months); and
5. rearing, growing out and rounding off of slaughter birds on dry-land Lucerne pasture in the southern Cape, from day-old until slaughter at 12-months of age.

Input and production standards, as given in the following chapter (*Ch. 4: Ostrich nutrition guidelines*) and a computer-based decision-making model (Brand, 2006) are used as the basis for all calculations. General assumptions include:

- all price data are based on the 2014 season;
- capital costs for the establishment of ostrich enterprises are excluded;
- the main variable costs in the production process are regarded as operating costs;
- interest on operating capital is calculated at 10% per year;
- fully balanced feed rations are fed;
- disease control is as per the proposed veterinary programme.







More specific assumptions are indicated under each system. For the purposes of any variation within the above-mentioned systems, whether with regard to feeding, herd health, self-mixing of feeds, changed production standards etc., the computerised model as developed by Brand (2006) and is available from Dr TS Brand (021 - 808 5225) at the Directorate: Animal Sciences (Elsenburg Research Farm).

## The Breeding Bird Unit

The following assumptions are made in the calculation of the economic viability of a breeding bird unit:

- fully balanced self-mixed rations are fed, with breeding rations for 8 months (245 days) and maintenance rations during the rest period (120 days);
- average egg production of 50 eggs per female, with hatching percentage of 60% (mortalities included);
- incubation costs are excluded;
- product income is calculated from the sale of egg shells and feathers;
- trading income is calculated from the sale of day-old chicks and culled breeding birds, minus the purchase of replacement breeding birds (10% replacement per year);
- a stable herd size is assumed and therefore no capital income is calculated;
- a 1:2 male:female system is assumed as a single breeding unit.

The potential economic viability of a typical breeding bird unit is shown in Table 13.1. According to Table 13.1 the potential gross production value is R20 905 per breeding unit, the directly allocable costs are R13 166 and the margin above specified cost R7 738. Expressed per marketable day-old chick (57 chicks per breeding unit) the production costs amount to R230.99 per chick, with a margin above cost of R135.76 per day-old chick (incubation costs are excluded). Feed cost represents the biggest cost item (83%) in the production system. A breeding bird consumes approximately 960kg feed per year at a cost of R3 657.



**Table 13.1** Margin above cost for an ostrich breeding bird enterprise in the Little Karoo

Item	Unit	Quantity	Unit price	Total			
				Breeding unit	Breeding bird	Breeding female	Day-old chick
<b>Gross production value:</b>				(R)	(R)	(R)	(R)
<b>Product income:</b>							
Feather sales	bird	3	375	1125.00	375.00	562.50	19.74
Egg shells sales	shells	20	29	580.00	193.33	290.00	10.18
<b>Trading income:</b>							
Sales: day-old chicks	chick	57	350	19 950.00	6 650.00	9 975.00	350.00
Sales: culled breeding birds	bird	0	3 000	900.00	300.00	450.00	15.79
Minus purchases: replacement birds	bird	0	5 500	-1 650.00	-550.00	-825.00	-28.95
<b>Total gross production value</b>				<b>20 905.00</b>	<b>6 968.33</b>	<b>10 452.50</b>	<b>366.75</b>
<b>Allocated direct costs:</b>							
Feed costs:							
- Breeding period (8 months)	kg	1 929	4.58	8 832.68	2 944.23	4 416.34	154.96
- Rest period (4 months)	kg	945	2.27	2 140.59	713.53	1 070.29	37.55
Veterinary- and medicine costs:							
- dose	bird	3	13.77	41.31	13.77	20.65	0.72
- vaccination	bird	3	28.62	85.86	28.62	42.93	1.51
- dip	bird	3	1.56	4.69	1.56	2.35	0.08
- antibiotics	bird	3	115.68	347.04	115.68	173.52	6.09
- vitamins	bird	3	150.80	452.40	150.80	226.20	7.94
Slaughter costs	bird	0.3	200.00	60.00	20.00	30.00	10.5
Slaughter levy SAOBC	bird	0.3	16.50	4.95	1.65	2.48	0.09
Interest on operating capital	rand	11 970	10.0%	1196.95	398.98	598.48	21.00
<b>Total allocated direct costs*</b>				<b>13 166.47</b>	<b>4 388.82</b>	<b>6 583.23</b>	<b>230.99</b>
<b>Margin above specified costs</b>				<b>7 738.53</b>	<b>2 579.51</b>	<b>3 869.27</b>	<b>135.76</b>

\*hatching cost excluded



The obviously important management factors which the entrepreneur has control over and which should be managed closely in order to ensure profitability are:

- Female productivity (eggs produced and hatchability)
- Feed management
- Herd health

A sensitivity analysis in Table 13.2 shows the influence of female productivity and feed costs on production cost, margin above cost and the number of marketable day-old chicks.

**Table 13.2** Sensitivity analysis: influence of change in certain management factors on chick production, production cost and margin per day-old chick

Management factors			Output		
Egg production per female	Hatchability (%)	Feed cost	Marketable day-old chicks	Direct cost per chick	Margin above cost per chick
-10%	constant	constant	51	256	110
-10%	-10%	constant	43	308	63
-10%	-10%	+10%	43	336	34
constant	constant	+10%	57	252	114
constant	constant	-10%	57	209	157
+10%	+10%	constant	73	180	183
+10%	+10%	-10%	73	165	198
+20%	+20%	-10%	91	131	230

According to Table 13.2, a 10% drop in egg production per female reduces the number of marketable day-old chicks to 51, with an accompanying rise of 11% in the unit production cost per chick and a corresponding drop of 19% in the margin above cost. With a drop of 10 percentage points in egg hatchability additional to a 10% drop in egg production per breeding female, the number of marketable day-old chicks decreases to 43, the production cost per chick rises by 33%, while the margin above cost drops by 54% to R63 per chick. When egg production and hatchability can be maintained according to industry norms, but feed costs increase by 10%, the margin decreases by 16% to R114 per chick. In cases where feed costs can be reduced by 10%, the margin will increase to R156 per chick. If both egg hatchability and egg production rise by 10 percentage points and 10% respectively – the number of marketable day-old chicks increases to 73, production cost per day-old chick drops by 22% to R180 and the margin above cost rises to R183 per chick. If feed cost can be lowered by 10% at the same time, the production cost drops further to R165 per chick and the margin above cost rises to R198 per chick. With a rise of 20% in egg production to 60 eggs per female and a corresponding 20 percentage points rise in hatchability to 80% (both feasible in practice), and accompanied by a drop of 10% in feed costs, the number of marketable day-old chicks increases to





91, the margin above cost increases to R230 per day-old chick. How effectively these factors are managed will determine how many day-old chicks per female can be produced – it will also influence the production costs and margin above cost per chick.

### Intensive Rearing Of Day-Old Chicks To 4-Months Of Age

For the intensive rearing of day-old chicks the following assumptions are made:

- day-old chicks are purchased at the current market price;
- fully balanced self-mixed full-feed rations are fed – pre-starter rations up to 81 days and starter rations up to 4 months;
- mortality up to 4 months is 30%;
- trading income is calculated from the sale of 4-month old birds for further rounding off;
- the potential margin above cost for the rearing of day-old chicks up to 4 months is calculated for a 100-chick unit and expressed per surviving marketable chick.

According to Table 13.3 the gross production value per 4-month old chick is R1 520.00, the directly allocable costs are R1 022.40, and the margin above specified cost amounts to R497.60. The purchase of day-old chicks and feed cost represent the largest cost items (50% and 40% respectively). Together with mortality these form the core factors over which the entrepreneur has control and which should be managed carefully to ensure the profitability of rearing day-old chicks.

**Table 13.3** Margin above cost for the rearing of 100 day-old chicks up to 4-months of age

Item	Unit	Quantity	Unit price	Total per 100-chick unit	Total per Marketable 4-months chick
<b>Gross production value:</b>				(R)	(R)
<b>Trading income:</b>					
Sale of 4 months chicks	chick	69	1 520.00	105 488.00	1 520.00
<b>Total gross production value</b>				<b>105 488.00</b>	<b>1 520.00</b>
<b>Allocated direct costs:</b>					
Purchase of day-old chicks	chick	100	350.00	35 000.00	504.32
Feed costs:					
- pre-starter	kg	3 418	5.09	17 400.56	250.73
- starter	kg	2 891	3.86	11 151.52	160.68
Veterinary and medicine costs:					
- dose	bird			452.73	6.52
- vaccination	bird			949.53	13.68
- antibiotics	bird			838.92	12.09
- probiotics	bird			1 116.20	16.08
- vitamins	bird			1 090.79	15.72
- amino acids	bird			279.75	4.03
SAOBC "tag"	bird			385.90	5.56
Interest on operational capital	rand	68 666	10%	2 288.86	32.98
<b>Total allocated direct costs</b>				<b>70 954.76</b>	<b>1 022.40</b>
<b>Margin above specified costs</b>				<b>34 533.24</b>	<b>497.60</b>





A sensitivity analysis (Table 13.4) shows that a 1% increase in monthly mortality reduces the number of marketable chicks to 65, while the unit production cost per chick rises by 5% and the margin above cost drops by 10% to R450. If monthly mortality rises by 2 percentage points, the number of marketable chicks decreases to 61 and the margin falls by 20%. If, together with this, there is a 10% increase in feed costs, the net effect is a 14% increase in cost, while the margin above cost decreases with 29% to R351 per chick. However, if feed costs and mortality could be reduced marginally, the margin above cost will evidently improve. According to calculations, an improvement in mortality per month of only 1 percentage point (4% in total over 4 months) elevates the margin above cost by 8% to R539 per chick and if the monthly mortality can be improved by 2 percentage points, the margin above cost rises to R577 per chick. If feed costs can be reduced at the same time by 10%, the margin above cost should improve to R618 per 4-month old chick. How effectively all these factors are managed, will determine the number of young chicks that would become available for sale or for further rounding off to slaughter age and therefore influence the margin above cost per chick

**Table 13.4** Sensitivity analysis: Influence of change in management factors on chick production, production cost and margin above cost per 4-month old marketable ostrich chick

Management factors		Results		
Mortality	Feed cost	Marketable chicks	Direct cost per chick	Margin above cost
+1%	constant	65	1 069	450
+2%	constant	61	1 123	397
+2%	+10%	61	1 168	351
-1%	constant	73	980	539
-2%	constant	77	943	577
-2%	-10%	77	902	618
+10%	-10%	73	165	198
+20%	-10%	91	131	230

## Intensive Rearing And Rounding-Off Of Slaughter Ostriches On Full-Feed Rations From 4 Months To Slaughter Age

For the intensive growing out and rounding off of ostrich chicks from 4 months to slaughter age the following assumptions are made:

- 4-month old chicks are bought at the current market price;
- fully balanced self-mixed, full-feed rations are fed – starter rations are fed up to 147 days of age, growth rations to 227 days of age and finisher rations up to slaughter age;
- slaughter ages at 10 and 12 months are illustrated;
- mortality from 4 to 12-month ages is 10%;





- product income is calculated from the sale of feathers at 6 months of age and again at slaughter age;
- trading income is calculated from the sale of slaughter birds to the abattoir (with income from both meat and skins);
- carcass mass, skin grading and skin sizes per age group are based on a study by Bhiya (2007) and the computer model of Brand (2006), taking into account the latest 2014 grading and price structures of the two main ostrich abattoirs in South Africa.

The potential margin above cost per slaughter bird is calculated for a 100-slaughter bird unit and presented in Table 13.5 per surviving marketable slaughter bird at slaughter age.

**Table 13.5** Margin above cost for a 100-slaughter bird unit (full-feed system) with different slaughter ages

Item	Unit	Quantity	Unit price	Total per marketable slaughter bird	
				10 months	12 months
<b>Gross production value:</b>				(R)	(R)
<b>Product income:</b>					
<b>Feathers</b>					
6 months	bird	96	150	157.34	160.49
10 months	bird	92	200	200.00	0.00
12 months	bird	90	400	0.00	400.00
<b>Trading income:</b>					
<b>Meat</b>					
10 months	kg	3749	19.80	807.81	0.00
12 months	kg	4042	21.00	0.00	942.34
<b>Skins</b>					
10 months	dm <sup>2</sup>	140.27	16.47	2 309.99	0.00
12 months	dm <sup>2</sup>	146.67	16.07	0.00	2 357.25
<b>Total gross production value</b>				<b>3 475.15</b>	<b>3 860.08</b>
<b>Allocated direct costs:</b>					
Purchases: 4-month chicks	chick	100	1 520	1 653.97	1 687.01
Feed costs :					
- starter(up to 147 days)	kg	3 676	3.86	154.28	157.36
- growth (up to 227 days)	kg	14 269	2.88	446.40	455.32
- round-off (up to 10 months)	kg	16 358	2.45	435.33	444.03
- round-off (10-12 months)	kg	14 086	2.45	0.00	382.35
Veterinary and medicine costs:					
- dose	bird			90.84	95.05
- antibiotics	bird			64.61	65.90
- vitamins	bird			9.56	11.63
- dip	bird			11.85	13.66
Slaughter costs	rand		200	200.00	200.00
Slaughter levy SAOBC	rand		16.50	16.50	16.50
Interest on operational capital	rand		10%	154.17	235.25
<b>Total allocated direct costs</b>				<b>3 237.51</b>	<b>3 764.07</b>
<b>Margin above specified costs</b>				<b>237.64</b>	<b>96.01</b>

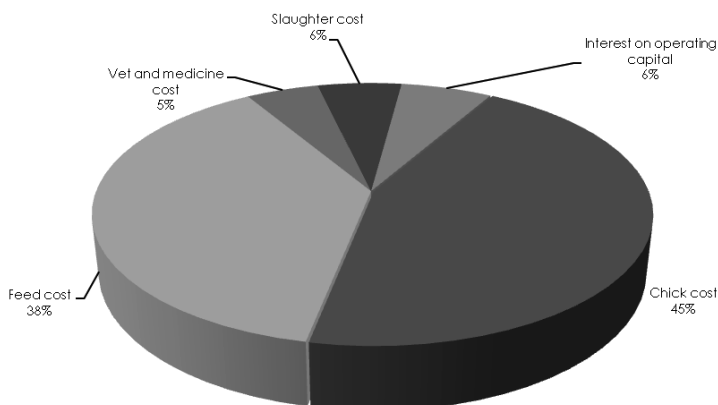
According to Table 13.5 the gross production value per slaughter bird is R3 475 for the 10-month slaughter age and R3 860 for the 12-month slaughter age. Skins proportionally render



the biggest income (66% and 61% respectively for slaughter at 10 and 12 months of age) with meat at 23% and 24%. Income from feathers has increased markedly the past few seasons and currently renders 10% and 15% of the income for the two respective slaughter ages. Although the carcass mass and skin size increase with slaughter age and the market clearly prefers larger skins with better follicle development, skins are generally graded lower due to skin damage. With later slaughter age feather quality also decreases, while at the same time feed consumption rises, coupled with a rise in feed cost. Although the income increases with slaughter age, the directly allocable costs per slaughter bird also increase, amounting to R3 237 and R3 764 for slaughter at 10 and 12 months of age respectively. The cost of 4-month old chicks and feed cost appears to be the two biggest cost items. The cost of 4-month old chicks represents 51% and 45% of the production cost for the respective slaughter ages and feed costs 32% and 38% of production costs.

The distribution of production costs for 12-month slaughter ostriches on full-feed rations is shown in Figure 13.1.

**Production cost of slaughter ostriches from 4-months to 12 months on full-feed systems**



**Figure 13.1** Proportional distribution of directly allocable costs for the production of 12-month slaughter ostriches on full-feed systems

Somewhat contrary to expectations of an apparent recovery of the ostrich industry, margins are currently (2014) still under pressure for this system of growing out 4-month old chicks to slaughter age. Although the prices for skins have doubled the past five years since 2009, meat prices have almost halved. The total income (gross production value) per slaughter bird indeed shows an increase since 2009 of between 28% (for 12-month slaughter age) and 38% (for 10 month slaughter age), however



the production costs over the same period have increased by between 42% (for 12-month slaughter age) and 45% (for 10 month slaughter age). Margins are currently low at R237.64 and R96.01 per slaughter bird for the 10 and 12 month slaughter ages respectively, excluding labour and transport costs.

Feed costs clearly play a crucial role in the economic viability of slaughter-bird production, which makes production management vitally important. A sensitivity analysis in Table 13.6 shows the influence of feed cost increases and decreases, together with changes in mortality, on margins above cost.

**Table 13.6** Sensitivity analysis: effect of change in management factors on production costs and margins per slaughter bird at different slaughter ages (full-feed system)

Management factors		Input		Output	
Mortality	Feed cost	Direct cost per slaughter bird 10 months	Direct cost per slaughter bird 12 months	Margin above cost per slaughter bird 10 months	Margin above cost per slaughter bird 12 months
constant	-10%	3 130	3 614	344	246
constant	-15%	3 075	3 535	400	325
constant	+10%	3 350	3 922	125	-62
-1%	constant	3 104	3 564	364	285
-1%	-10%	2 998	3 417	469	432

According to Table 13.6 a 10% drop in feed costs increases the margin above cost of the 10-month slaughter age to R344 per bird and that of the 12-month slaughter age to R246 per bird. A 15% decline in feed costs raises the margins to R400 per bird and R325 per bird for the respective slaughter ages. If mortality can be decreased by 1 percentage point per month, together with a 10% decrease in feed costs, margins could be increased to R469 at 10-months slaughter age and to R432 at 12 months slaughter age. In contrast to this, when feed costs increase with 10%, it is clear from Table 13.6 that margins are substantially negatively affected for both systems. Producers, who purposely try to lower mortalities and manage feed costs optimally, can increase their margins.

## Full System Of Rearing, Growing Out And Rounding-Off Of Slaughter Ostriches From Day-Old To Slaughter Age

If a producer follows the full production system from the purchase of day-old chicks and rearing up to slaughter age, the margin above cost per marketable slaughter ostrich will amount to R720.94 and R562.27 for slaughtering at 10 and 12 months respectively (Table 13.7). However, what has to be taken into account from a cash flow perspective is that only about 60-62 marketable slaughter ostriches per 100-bird unit will be







delivered, given the effect of the high mortality rate of day-old to 4 month age birds. A sensitivity analysis in Table 13.8 shows the influence of changes in mortality, together with feed cost increases and decreases, on the margins.

**Table 13.7.** Margin above cost for rearing, growing out and rounding-off of slaughter ostriches from day-old to slaughter at different ages (100-slaughter bird unit; full-feed system)

Item	Unit	Quantity	Unit price	Total per marketable slaughter bird	
				10 months	12 months
<b>Gross production value:</b>				(R)	(R)
<b>Product income:</b>					
<b>Feathers</b>					
6 months	66	150	159.84	164.64	160.49
10 months	62	200	200.00		0.00
12 months	60	400		400.00	400.00
<b>Trading income:</b>					
<b>Meat</b>					
10 months	2 519	19.80	807.81		0.00
12 months	2 690	21.00		942.34	942.34
<b>Skins</b>					
10 months	dm <sup>2</sup>	140	16.47	2 309.99	
12 months	dm <sup>2</sup>	147	16.07		2 357.25
<b>Total gross production value</b>				<b>3 477.65</b>	<b>3 864.23</b>
<b>Allocated direct costs:</b>					
Purchase of day-old chicks	chick	100	350	566.80	583.82
Feed costs :					
- pre-starter	kg	3 418	5.09	281.79	290.25
- starter (4 months)	kg	2 891	3.86	180.59	186.01
- starter (4-6 months)	kg	2 536	3.86	158.39	163.14
- growth (6-7.5 months)	kg	9 691	2.88	451.22	464.77
- round-off (7.5-10 months)	kg	10 978	2.45	434.78	447.83
- round-off (10-12 months)	kg	9 349	2.45		381.40
Veterinary and medicine costs:					
- dose	bird			99.09	104.46
- antibiotics	bird			78.20	80.55
- dip	bird			12.04	13.96
- vaccination	bird			15.38	15.84
- probiotics	bird			18.08	18.62
- vitamins	bird			27.27	29.96
- amino acids	bird			4.53	4.67
Slaughter costs	rand		200	200.00	200.00
Slaughter levy SAOBC	rand		16.50	16.50	16.50
Interest on operational capital	rand		10%	212.05	300.18
<b>Total allocated direct costs</b>				<b>2 756.71</b>	<b>3 301.96</b>
<b>Margin above specified costs</b>				<b>720.94</b>	<b>562.27</b>





According to Table 13.8 a 1% increase in monthly mortality reduces the number of 12 month old marketable birds to 48, while the unit production cost per bird rises by 13% and the margin above cost drops by 71% to R165. If monthly mortality rises by 2 percentage points, the number of marketable birds decreases to 37 and the margin falls to -R477. If, together with this, there is a 10% increase in feed costs, the net effect is a 42% increase in cost, while the margin above cost decreases to -R756 per bird. However, if feed costs and mortality could be reduced marginally, the margin above cost will evidently improve. If mortality can be kept constant according to existing production norms, but feed costs can be decreased by 10%, the margins will increase to R772 per 12 month bird. A drop of 15% in feed costs will result in a margin of R880 per bird. An improvement in mortality per month of 2 percentage points over the entire period, together with a 10% decrease in feed costs elevates the margin above cost by 94% to R1 089 per bird. How effectively all these factors are managed will influence the number of birds to be marketed and also the profitability of the system.

**Table 13.8** Sensitivity analysis: effect of change in management factors on production costs and margins per slaughter bird at different slaughter ages (full-feed system, day-old to slaughter)

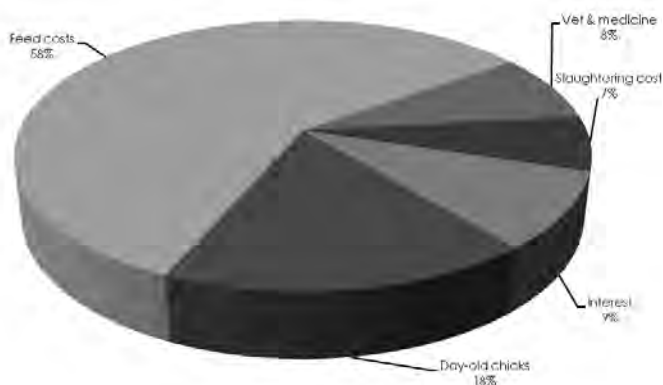
Management factors		Results at 12 months		
Mortality	Feed cost	Marketable chicks	Direct cost per bird	Margin above cost
+1%	constant	48	3 720	165
+2%	constant	37	4 399	-477
+2%	+10%	37	4 678	-756
constant	-10%	60	3 092	772
constant	-15%	60	2 985	880
-2%	-10%	77	2 760	1 089

The cost of feed and day-old chicks appears to be the two biggest cost items. The cost of feed represents 58% of the production cost for the 12 month slaughter age system, while the costs for day-old chicks amount to 18% of production costs. The distribution of the production cost of slaughter ostriches from day-old to 12-months on full-feed rations is shown in Figure 13.2.





**Production cost of slaughter ostriches from day-old to 12 months on a full-feed system**



**Figure 13.2** Proportional distribution of directly allocable costs for the production of 12-month slaughter ostriches from day-old on full-feed systems

### **The Rearing, Growing Out And Rounding-Off Of Slaughter Ostriches On Pastures In The Southern Cape From Day-Old To Slaughter Age At 12 Months Of Age**

Dryland Lucerne pastures in the southern Cape are used to illustrate the potential margin above cost for the production of slaughter birds from pastures. The following assumptions are made:

- day-old chicks are purchased at current market prices;
- fully balanced, self-mixed full-feed rations are fed up to 2 months age (pre-starter ration);
- at 2 months chicks are put out on Lucerne pastures, with additional self-mixed rations (starter rations up to 4 months, growth rations up to 6 months, round-off rations up to 11.5 months and maintenance rations for 14 days in the quarantine paddocks);
- cost of the Lucerne pasture is calculated by spreading the total establishment cost and maintenance cost over a life span of 4 years, taking into account that Lucerne is converted to grain cultivation every 4 years;
- average dry matter yield of 4 tonnes per hectare is assumed, adjusted by 30% for trampling and wastage;
- mortality is the same as in intensive systems;
- slaughter age is at 12 months.

Table 13.9 shows the potential margin above cost per slaughter bird as calculated for a 100-slaughter bird unit and expressed per surviving marketable slaughter bird at slaughter age.





**Table 13.9** Margin above cost for a pasture-based 100-slaughter bird unit

Item	Unit	Quantity	Unit price	Total per 100-slaughter bird unit	Total per Marketable slaughter bird 12 months
<b>Gross production value:</b>				(R)	(R)
<b>Product income:</b>					
<b>Feathers</b>					
6 months	bird	65	150	9 735.00	163.61
12 months	bird	60	400	23 800.00	400.00
<b>Trading income:</b>					
<b>Meat</b>					
12 months	kg	2609	26	67 309.34	1 131.25
<b>Skins</b>					
12 months	dm <sup>2</sup>	147	14	123 026.98	2 067.68
<b>Total gross production value</b>				<b>223 871.32</b>	<b>3 762.54</b>
<b>Allocated direct costs:</b>					
Purchase of day-old chicks	chick	100	350	35 000.00	588.24
Feed cost*:					
- pre-starter (0-2 months)	kg	2 154	5	10 968.35	184.34
- starter (2-4 months)	kg	4 174	4	16 098.42	270.56
- growth(4-6 months)	kg	5 995	3	18 228.11	306.35
- finisher (6-10 months)	kg	15 659	2	29 312.98	492.66
- finisher (10-11.5 months)	kg	6 401	2	11 981.52	201.37
- maintenance (quarantine)**	kg	2 146	2	4 017.05	67.51
Veterinary and medicine costs:					
- dose	bird			6 262.60	105.25
- antibiotics	bird			4 829.00	81.16
- dip	bird			837.09	14.07
- vaccination	bird			949.53	15.96
- probiotics	bird			1 116.20	18.76
- vitamins	bird			1 795.83	30.18
- amino acids	bird			279.75	4.70
SAOBC " tag"	bird			385.90	6.49
Slaughter costs	bird	60	200	11 900.00	200.00
Slaughter levy SAOBC	bird	60	26.50	1 576.75	26.50
Interest on operational capital	rand		10%	15 553.91	261.41
<b>Total allocated direct costs</b>				<b>171 092.99</b>	<b>2 875.51</b>
<b>Margin above specified costs</b>				<b>52 778.33</b>	<b>887.03</b>

\*feed cost based on Lucerne pasture/concentrate mixture

\*\* continue with finisher ration

According to Table 13.9 the gross production value per slaughter bird is R3 762.54, the directly allocable costs are R2 875.51 and the margin above specified costs thus amounts to R887.03. Feed is the biggest cost item (53%), followed by day-old chick cost (20%), veterinary and medicine costs (10%)

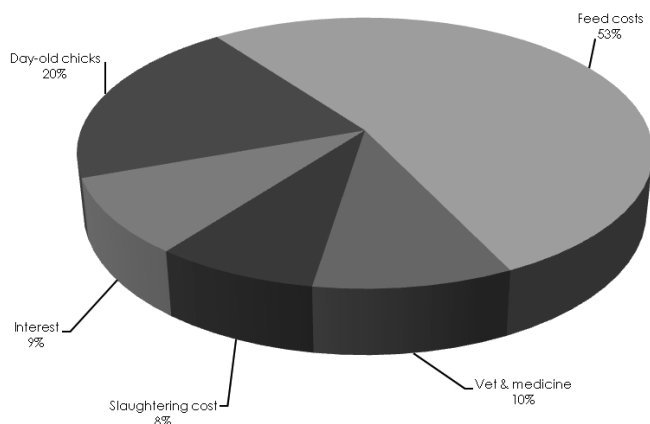




and interest on operating capital (9%). The total feed cost is however less than in full-feed systems and thus influences the margins positively. Margins are however still sensitive to feed-cost fluctuations and pastures should be managed carefully.

The distribution of the production cost of slaughter ostriches from day-old to 12-months on pastures is shown in Figure 13.3.

**Production cost of slaughter ostriches from day-old to 12 months on dryland lucerne pasture**



**Figure 13.3** Proportional distribution of directly allocable costs for the production of 12-month slaughter ostriches from day-old on dryland cultivated pastures.

The model of Brand (2006) enables further predictions regarding margins above feed cost for different production systems, different pasture/concentrate combinations, different scenarios in terms of changes in feed composition and feed prices, different slaughter ages, as well as changes in product prices of meat, skins and feathers.

## Summary

This chapter illustrates the potential margins achievable with certain production and management systems. The viability of ostrich production depends on various factors – thus it is important for producers to focus on those aspects of the business that they can control and manage. Some management factors emerging from the analyses are:

- Female productivity (eggs produced and hatchability)
- Feed management and feed cost
- Mortality
- Optimal slaughter age, weight and skin size
- Herd health





- Skin and feather quality
- Genetics
- Choice of production system

The measure to which these factors are managed will contribute to the economic viability of the enterprise, regardless of choice of production system.

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## 14 | Biodiversity

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## Introduction

Biodiversity and sustainable management are becoming increasingly important in the agricultural sector and are certainly aspects that farmers cannot afford to ignore.

The ostrich industry is made the scapegoat for the deterioration of the natural veld, specifically the very fragile and unique Succulent Karoo. But is the industry really guilty of the degraded condition of natural veld? And how can ostrich farmers ensure that they do not contribute to the further deterioration and destruction of the veld? Better still, how can farmers contribute to the improvement of the natural veld?

## How Is Biodiversity Management Important?

In every article on sustainable development – the interdependent aspects of it are mentioned: environmental, social and economic. One of the most acceptable definitions of sustainable development is: 'development that satisfies the needs of today without threatening the potential of future generations to satisfy their own needs'. The crux of this definition is a stable relationship between human activities and the natural environment that will not impede the prospects of future generations to lead a quality life (at least as good as ours). Ecosystem services are central in this definition – without them the social and economic aspects cannot exist (see sketch below).

We are wholly dependent on nature – not only on agriculture as a food basket, but also in our daily lives as a filter to disasters, provider of essential needs, etc. There are ecological processes, for instance, which have a large influence on our quality of life – there are many examples of this. One example is clean water: rain water seeps into the soil, from where it supports plant life, provides habitats, supports animal life – a diversity of plants are essential for a diversity of animals, for shelter, food, etc. If this order is disturbed, for instance, by destroying plants that serve as a natural filter during heavy rains, it would be to our own detriment – most of the water will not be absorbed by the soil, but will run off where it could do damage further down-stream.





(Think about infrastructure damage, such as bridges that are washed away or because of erosion.)

What has this got to do with the ostrich industry? The answer is simple: everything! If we are not going to look after nature, it will also not look after us.

## **Biodiversity Management In The Little Karoo**

The Little Karoo, where about 75% of the ostrich industry is settled in the Western Cape, is biologically very rich. A large part of the Little Karoo is situated in the Succulent Karoo, one of the 34 internationally recognised biodiversity hotspots. The other 2 hotspots are the fynbos biome of the Cape Floral Kingdom and the subtropical thicket biome of Maputaland-Pondoland-Albany.

A biodiversity hotspot is characterized by 2 features:

- It is threatened: at least 70% of the original biome is destroyed due to human activity
- the remaining 30% is biologically rich: it has at least 1 500 species of which 40% are endemic (not occurring anywhere else in the world).

Detailed mapping of the Little Karoo (Vlok et al. 2005) confirmed an unbelievable 369 vegetation units in 56 habitat types – truly noteworthy biological diversity!

Unfortunately, much of this biodiversity is ruined. A study on the transformation (read: degradation) of the Little Karoo vegetation (Thompson et al. 2005), showed that a large part of the low-lying areas in the region is degraded. In a follow-up study Reyers (2009) established that 25 of the vegetation units are critically endangered (less natural veld is left than the minimum area required to protect the unit), 29 units are endangered (less than the minimum required + 15%), and 30 are vulnerable (less than 60% of the vegetation type still survives). Kirkwood et al. (2007) pointed out that a large percentage of this veld, especially in the ostrich-producing areas, are endangered or critically endangered.

To paint an even bleaker picture, less than 3.5% of the succulent Karoo biome's vegetation types are formally protected – and the pressure on the environment is not decreasing!

In the low-lying parts of the Little Karoo (where most of the ostrich farming occurs), the degradation of the biodiversity results in long-term negative impacts – this affects not only the ecological systems, but also the farming potential of the soil and the social health of the area.

## **More Reasons Why Biodiversity Management In The Little Karoo Should Be Preserved**

The loss of plants usually leads to a loss of soil, due to water and wind erosion. This of course also has a direct impact on







farming and biodiversity. Vegetation plays a critical role in water retention and infiltration into the soil. It reduces the rainfall splash-effect and slows down the run-off – this in turn provides mulch that serves as a natural erosion barrier; it also creates a habitat beneficial to ground covers (mosses and lichens) that are so important to keep these systems healthy. A healthy environment, with a large plant diversity and ample ground cover, provides critical natural services by stemming excess run-off on the plains, and preventing flooding and siltation of floodplains. (The high cost of damage due to floods in the Little Karoo is well known.)

The resistance of the ecological system is a critical survival mechanism, particularly in harsh environments such as the Little Karoo. Plants interact: some provide an environment conducive to the germination and growth of seeds, larger species provide protection from the sun and shade to keep the soil cooler, others provide traps for windblown seeds, so creating seed banks in this manner. Some species cover holes left by erosion or dead plants, until other, longer-living plants can develop. A diversity of plants creates better resistance to the impacts of stress periods, such as droughts.

Tourism is an important economic driver in the Little Karoo. A study by Gelderblom (2006) pointed out that the open spaces and pristine landscapes of the Little Karoo are an appealing tourist attraction. The destruction or damaging of biodiversity will have obvious impacts on this economic sector.

Because ostrich farming is the largest contributor to the economy of the Little Karoo, and because this activity has such a serious impact on the biodiversity of the area, it is imperative to develop alternative ostrich-farming methods that will ensure the sustainability of the ostrich industry while conserving this internationally important biodiversity hotspot.

## **What Can The Ostrich Farmer Do To Promote Biodiversity Management On His Farm?**

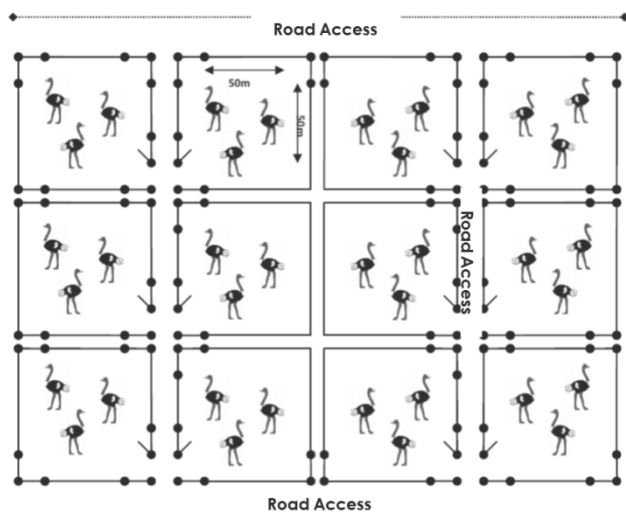
The easy answer is to keep to the proposed ecological carrying capacity standard of 1 ostrich per 22.8 ha natural veld. If the farmer uses flock breeding in a three-camp system, 1 ostrich per 5 hectares for an 8-month period is advised, after which the ostriches should be removed from the camp (natural veld) for 4 months. Thereafter the ostriches should go to a different camp while the first camp rests for 2 years. After 8 months the ostriches should be removed from the second camp (again for 4 months) and then be put into a third camp, while the second camp also rests for two years. This process can then be repeated.

In a system like this however, it is difficult to determine which ostriches are the producers and which ones are not. The





ostrich industry advises farmers to rather use the small camp-breeding system. This means that 2 or 3 ostriches (1male with 1 or 2 females) are kept in a small camp of 0.25 hectare. The advantage of such a system is that selection can be done: with detailed record keeping the farmer can identify the producers, and the non-producers can be taken out of the system. Better production can thus be achieved with fewer ostriches. This has obvious economic advantages for the farmer, while biodiversity also benefits – the farmer uses a small area of his farm for production while the remainder of the natural veld is managed better.



**Figure 14.1** Example of a small camp system

To erect small camps on natural veld, the farmer has to apply to the Department of Environmental Affairs and Development Planning. It is quite a lengthy and involved process and the SAOBC and CapeNature could assist. The industry however, in partnership with agriculture and conservation is currently in the process to develop industry standards (best practices) that will streamline and shorten the environmental process and ensure a sustainable industry.

## Legislation

Over the last number of years South Africa's environmental legislation has improved considerably. It places more pressure on the farmer to make changes on his farm within the limits of the law. The following tables should help the farmer with processes that need to be followed in order to stay within the law. (For more enquiries contact the Provincial Department of Environmental Affairs and Development Planning – 044 805 8600).



## Environmental Legislation Relevant To The Ostrich Industry

At the end of the table see the relevant telephone numbers of departments referred to in the last column

Activity	What are you planning?	Relevant legislation	Implication of the legislation	Responsible Department
Land usage	The transformation or removal of indigenous vegetation of 3 ha or more, or of any size where the transformation or removal occur within a critically endangered or endangered ecosystem. <i>This includes the following actions on natural veld:</i> <ul style="list-style-type: none"> <li>Erecting small camps</li> <li>Erecting feeding camps</li> <li>Clearing fields for cultivation</li> </ul> Also removal of natural vegetation from strip cultivation	Conservation of Agricultural Resources Act 43 of 1983 Environment: Conservation Act 73 of 1989 National Environment Management: Act 107 of 1998 National Environment Management: Biodiversity Act 10 of 2004 National Water Act 36 of 1998	If you plan deforestation of any natural veld, you need to apply for the necessary approval and permits.  <i>If you want to change current land usage (eg. making feeding camps or small camps on natural veld), you need to apply to the Department of Agriculture and Forestry.</i> <i>A set process has to be followed. Public participation forms part of this process.</i>	To start the process, contact: <ul style="list-style-type: none"> <li>Department of Agriculture and Forestry</li> <li>Department of Environmental Affairs and Development Planning.</li> </ul> Other stakeholders: <ul style="list-style-type: none"> <li>CapeNature</li> <li>Your Local Authority</li> <li>Department of Water and Forestry</li> <li>Department of Agriculture (provincial and national)</li> </ul>
	The construction of a road wider than 4 metres or with a reserve of 6 metres.	National Environment Management Act 107 of 1998	Before going ahead with construction of a road, application needs to be made to the Department of Environmental Affairs and Development Planning. Public participation forms part of this process.  <i>Consider the following factors: vegetation, the flood line (if the road is made close to a river) and erosion.</i>	CapeNature Your Local Authority Departments involved with your application: <ul style="list-style-type: none"> <li>Provincial Department of Environmental Affairs and Development Planning</li> <li>Department of Water and Forestry</li> </ul> (provincial and national)



Activity	What are you planning?	Relevant legislation	Implication of the legislation	Responsible Department
Fire	Fire Protection Associations (FPA's)	National Veld and Forest Fires Act 101 of 1998	<p>A FPA can be constituted by any group of owners to jointly manage veld- en forest fires in an area which as a relatively uniform fire regime.</p> <p><i>A FPA has to develop and apply a bush-fire management strategy, make binding rules to which all the members must adhere, handle fire prevention and fire fighting and improve the joint management of bush and veld fires. Membership is however voluntary for private land owners, but compulsory for owners of state land.</i></p>	Department of Water Affairs and Forestry; Forestry, Western Cape
	Prevention of fires with the National Fire Danger Rating System (NFDRS)	National Veld and Forest Fires Act 101 of 1998	<p>A fire danger rating system has been developed as an effective early warning- and prevention system. On red days the chance for fires are extremely high, and on orange days it is high. On these days special measures have to be in place. The Department of Water and Forestry may place a ban on the kindling, use or on-going stoking of outdoor fires. As the danger of fire is negligible on blue days, no measures are in place for those days.</p>	Department of Water Affairs and Forestry; Forestry, Western Cape

Activity	What are you planning?	Relevant legislation	Implication of the legislation	Responsible Department
	Prevention of fires and fire fighting	National Veld and Forest Fires Act 101 of 1998	Land owners must prepare fire breaks on their side of fences where there is a fair risk of fires, <i>(not applicable to land owners belonging to a FPS)</i> Land owners must have enough trained personnel and equipment to have a reasonable chance of fighting a fire. Land owners must do everything in their power to fight and prevent fires.	Department of Water Affairs and Forestry; Forestry, Western Cape
Invader species	The eradication of exotic invader species such as black wattle, sesbania, bluegum trees, poplars, fir trees. The prevention of the spreading of invaders and the planting of windbreaks.	National Environment Management Act 107 of 1998 National Environmental Management: Biodiversity Act 10 of 2004	Exotic invader species are divided into various groups, from 1 to 3, depending on the rate at which they are spreading and the risk they pose to the natural environment. Land owners must pay attention to species in all these categories. The planting of wind breaks must be demarcated and approved.	Department of Agriculture
Indigenous plants and trees	Buying and selling of protected plants (such as succulent plants, buchu, proteas and erica's)	Nature and Environmental Conservation Ordinance 19 of 1974 Provincial Notice 955 of 1975 National Environmental Management: Biodiversity Act 10 of 2004	You may only buy/sell protected plants if the premises/property from which you are buying/selling is registered.	CapeNature



Activity	What are you planning?	Relevant legislation	Implication of the legislation	Responsible Department
	Picking and being in possession of protected plants (such as succulent plants, buchu, proteas and erica's)	Nature and Environmental Conservation Ordinance 19 of 1974 National Environmental Management: Biodiversity Act 10 of 2004	You may only pick protected plants if you are in possession of a permit or written permission from the land owner.  For the illegal picking, trading or possession of protected plants, fines of R10 000 and/or two years imprisonment and/or three times the market value of the flowers could be imposed.	CapeNature
	Transport, export and import of protected plants	Nature and Environmental Conservation Ordinance 19 of 1974 National Environmental Management: Biodiversity Act 10 of 2004	You are required to have your picking permit and other written documentation with you at all times.	CapeNature
	Removal and/or chopping down of protected trees (such as yellow wood or milkwood)	National Forest Act 84 of 1998 National Environmental Management: Biodiversity Act 10 of 2004	You are not allowed to chop down, disturb, damage or destroy any protected tree, or be in possession of, collect, remove, transport, export, buy, sell or be in possession in one way or another, of any forest product from protected trees, unless you are in possession of a licence issued by the Department of Water Affairs and Forestry.	Department of Water Affairs and Forestry; Western Cape Forestry
Wild animals	Stock losses caused by wild animals	National Environmental Management: Biodiversity Act 10 of 2004	Currently permits are needed for the night hunting of caracal or black-backed jackal that cause stock losses.	CapeNature

Activity	What are you planning?	Relevant legislation	Implication of the legislation	Responsible Department
	Putting out poison	Nature and Environmental Conservation Ordinance 19 of 1974 National Environmental Management: Biodiversity Act 10 of 2004	No one is allowed to put out or allow the putting out of poison where it could be ingested by a wild animal.	CapeNature
Water	Construction of a dam, where the highest part is 5 m or higher or where the high-water mark of the dam extend over an area of 10 ha or more.	National Environment Management Act 107 of 1998 National Environmental Management: Biodiversity Act 10 of 2004	The construction of dams must be approved by Local Authorities, Agriculture, Water Affairs, and Development Affairs, before the construction may go ahead. Application must be done to the Department of Environmental Affairs and Development Planning.	<u>Your Local Authority</u> Departments involved with your application: <ul style="list-style-type: none"> <li>Provincial Department of Environmental Affairs and Development Planning</li> <li>Department of Water Affairs and Forestry</li> <li>Department of Agriculture (provincial and national)</li> </ul>
	The extraction of ground water where the volumes are more than 1cubic metre per hectare.	National Water Act 36 of 1998	Before proceeding with the extraction of ground water, application has to be made to the Department of Environmental Affairs and Development Planning, public participation forms part of this process. Contact your Department of Water Affairs and Forestry for the necessary information, documentation and maps.	<u>Your Local Authority</u> Departments involved with your application: <ul style="list-style-type: none"> <li>Provincial Department of Environmental Affairs and Development Planning</li> <li>Department of Water Affairs and Forestry</li> <li>Department of Agriculture (provincial and national)</li> </ul>



Activity	What are you planning?	Relevant legislation	Implication of the legislation	Responsible Department
	Registration of water uses	National Water Act 36 of 1998. (Article 26 (1)(c) and 34 (2))	The purpose of the registration is to manage our water resources, to ensure better planning and development and to protect it from negative influences. Individuals e.g. farmers businesses and water-use associations must apply for registration. Registration forms are available from any office of the Department of Water Affairs and Forestry.	Department of Water Affairs and Forestry: Forestry, Western Cape
	Licensing for water uses	National Water Act 36 of 1998. (Article 22)	The first step in the process is to contact your local Department of Water Affairs and Forestry office. Your application form must be accompanied by a succinct motivational report and a fixed fee. This report must include a section on which an assessment can be done. The Department may require that an advertisement is placed in the media to obtain public comment.	Department of Water Affairs and Forestry: Forestry, Western Cape



Activity	What are you planning?	Relevant legislation	Implication of the legislation	Responsible Department
	Water resources management fees	Chapter 5 of the National Water Act 36 of 1998	<p>Since April 2002 farmers, foresters, mines, industries, municipalities, water provision services (including water councils) are obliged to pay for water resources management.</p> <p>A water resources management fee is currently levied for the extraction of water from a water resource, and for activities that result in a decline of stream flow. Additional fees may be charged later on for storage and waste release. All fees will be used within the water Management realm.</p>	Department of Water Affairs and Forestry; Forestry, Western Cape
	Waste Management	National Water Act 36 of 1998 (Article 19)	Waste water is regarded as a type of pollution coming from dirty water and landing up in streams when it rains.	Department of Water Affairs and Forestry
	Dump Sites	Environment Conservation Act 73 of 1989 (Article 20)	Only approved areas may be used as a dumping terrain.	Department of Water Affairs and Forestry



## Relevant Telephone Numbers And Contact Details

<b>Department of Agriculture</b>	Beaufort West	023 414 2126
	Oudtshoorn	044 272 6077
	George	044 803 3700
	Mossel Bay	044 690 5109
	Riversdal	028 713 3305
	Swellendam	028 514 1196
<b>Dept of Agriculture (National)</b>	CapeTown	021 483 4930
<b>CapeNature</b> www.capenature.co.za	Cape Town	021 483 0000
	George	044 802 5300
	Oudtshoorn	044 203 6300
	Bredasdorp	028 542 1114
	Riversdal	028 713 2366
<b>Dept of Environmental Affairs and Development Planning</b>	George	044 805 8700
	Cape Town	0860 142 142
<b>Department of Water Affairs and Forestry</b>	Western Cape - Bellville	021 950 7100
	George	044 802 2700
	Knysna	044 302 6900
	Oudtshoorn	044 272 4634
<b>Your Local Authority</b>	Albertinia	028 735 8000
	Barrydale	028 572 1082
	Beaufort West	023 414 8100
	George	044 801 9111
	Heidelberg	028 722 8100
	Knysna	044 302 6300
	Ladismith	028 551 1023
	Mossel Bay	044 606 5000
	Oudtshoorn	044 203 3000
	Swellendam	028 514 1100

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## 15 | Key Data: Ostriches

### Weight

#### Chicks

- Day old: 700-750 g (Preferably 800-850 g)
- 3-months old: 25-30 kg
- 6-months old: 55-60 kg
- 12-months old: 90-110 kg

#### Adult birds

- Male: 100-145 kg (heavier for Reds and Blues – average 130-175 kg)
- Female: 95-140 kg (heavier for Reds and Blues – average 100-150 kg)

### Systems

#### Ostrich farming systems

An ostrich farming system could comprise one/more than one/ all of the following facets:

- Breeding birds and egg production
- Incubation and hatching of eggs
- Rearing of chicks up to 3 or 6 months
- Rearing of slaughter birds from 3 or 6 months to slaughter age

#### Mating systems

- Herd mating – birds kept in breeding herds of, on average, 50-100 birds, with 5-7 males for every 10 females
- Individual mating – breeding pairs, threesome breeding units (1 male, 2 females), foursome breeding units (1 male, 3 females)

#### Production systems

- In extensive systems males and females are kept in large herds (average of 50-100 birds per herd and in a ratio of 5-7 males for every 10 females). Eggs produced are hatched by the birds and the chicks reared by the parents.
- In intensive systems, herd mating and/or individual mating are practised. Eggs are collected daily and artificially incubated.

### Incubation Of Eggs

- Natural incubation – eggs are incubated and hatched by breeding birds
- Artificial incubation – eggs are incubated and hatched in wooden or electronic incubators. Incubators may be used both as incubators and hatchers, in other words, both phases of artificial incubation take place in one machine.





Eggs may be incubated in setters and then transferred to hatchers where the chicks hatch.

- Eggs for incubation may be produced on the farm or purchased from an external source.

## Chick Rearing

Day-old to 3 months /slaughter age:

- Extensive – chicks are reared by breeding birds to approximately 3 months.
- Intensive – chicks are reared in chick houses from day-old.
- Semi-intensive/semi-extensive: chicks are reared artificially on pasture, soil or cement, or a combination of different systems.

3 months to slaughter age:

- Chicks of 3 months and older can be reared in groups of 50-100 birds on a 1 ha area. Chick groups are usually classed by weight to limit competition at feeding-troughs. Young slaughter birds appear to favour groups of 75 birds per hectare and produce better in comparison with, for instance, groups of 75+ to 100 birds. In the latter case too high a load could lead to abnormal behaviour such as chewing feathers, which in turn could affect skin quality.

## Reproduction

### Breeding season

In the Little Karoo the traditional breeding season is from May/June to January because the peak production period of ostriches is stimulated by the lengthening of daylight.

### Sexual maturity

SA Black males become sexually active at approximately 3 years and females at 2 years of age.

Zimbabwean Blue and Kenyan Red males become sexually active at approximately 4 years and females at 3 years of age.

### Egg production

In the case of the SA Blacks, a breeding female can already be included in a breeding system at 2-yearage, but she only reaches her full potential at a 3-year age. Comparative figures are not available for the other two races. A female ostrich can be productive up to a relatively advanced age, but optimal production is achieved to an age of 9-10 years.

Egg production potential varies considerably, with 0-120 eggs per female produced per breeding season. A female that produces well must lay 8-10 eggs per month, producing on average 50-60 eggs/female/breeding season. If she is left to





incubate and hatch herself, she can produce up to 3 broods of chicks per breeding season, on average 40 to 50 eggs/female. In nature an average of 15-20 eggs are laid per clutch. Up to 34 eggs in a clutch have been reported.

Average egg mass is 1500 g.

Incubation time for eggs is 42 days.

When eggs are collected for artificial incubation, the eggs should not be stored for longer than 5-6 days before they are incubated. Eggs must be stored at 15-20°C and 75% RH. In cases where eggs are not collected daily, eggs should not be left in the nest for more than 2-3 days before they are collected.

Eggs are incubated for 42 days at 36°C and relative humidity of not higher than 28%.

Average hatchability varies from 40-80%.

Average fertility is 75-80%, in some cases as high as 98%. Infertile eggs: 15-20%

Average% dead-in-shell losses are 10-15%

## Marketing

Annually approximately 250 000 ostriches are slaughtered at national abattoirs, of which approximately 65% come from the Little Karoo area.

Skins, meat and feathers are the three main income sources in the ostrich industry.

Skins contribute approximately 50% to the total income, meat approximately 45%, and feathers approximately 4-5%.

The vast majority of ostrich meat is exported to the East, Germany, Netherlands and France, with a limited availability on national markets.

Skins are exported mainly to the East and France.

Feathers are mainly exported to the East, France, and also South America.

## Slaughtering Of Ostriches

Slaughter age: 10-14 months

Slaughter weight: 90-110 kg

Optimal skin surface area: 130 dm<sup>2</sup>

Optimal carcass weight: 43 kg

Feather weight per ostrich: 1.2-1.6 kg

## Utilization Of Veld By Breeding Birds

In the Little Karoo where the largest concentration of breeding birds in South Africa occur, the natural veld is used only as holding areas for breeding herds, in both the breeding and rest





seasons. The natural vegetation does not have good nutritional value and breeding birds usually receive fully balanced breeding rations during the breeding season (3 beginning of June to end of January). The keeping of ostriches and particularly breeding ostriches on natural veld in the Little Karoo is a sensitive subject, because of the large ecological impact of the birds on the veld in terms of trampling, and because ostrich farming is the main farming activity in this region. Presently it is difficult to make a specific recommendation in terms of the correct loading on a particular veld surface area. Much research still needs to be done in this regard. The South African Ostrich Business Chamber may be consulted for the existing guidelines on the keeping of breeding ostriches on natural veld. The current guidelines are:

- For breeding pairs and/or threesome breeding units a maximum paddock size 0.25 ha should be allowed, with the understanding that the birds receive full breeding rations.
  - For breeding herds the camp size may vary from 1 ha to 100 ha. It is recommended that with this system the birds are fed breeding rations and they should not be dependent on the veld for feed. The loading of the veld will be determined by its condition and vegetation composition. It is important to remember that an interaction has been found between herd size, camp size and the production of breeding birds. Egg and chick production declines with an increase in herd size.
  - It is important to rotate herds between camps annually, in order to protect the veld condition as much as possible. Alternatively, at least 3 camps should be available per herd to facilitate the rotation between camps. Camp A will, for instance, be used in year 1 and then be rested for 2 years, only to be used again in the fourth year.
  - There should be at least one feed point and one water point available per 50 ha – to prevent the trampling and bunching of breeding birds in certain areas in the camp.
  - During the rest period (3 February to end May in the southern hemisphere, the breeding birds should preferably be kept in feeding paddocks or in salt-bush camps.





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*Suid-Afrikaanse Volstruisboere Koöperasie Beperk 7*





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