LIVESTOCK
PRODUCTION MANUAL

Guidelines for sustainable and
profitable livestock production

SECOND EDITION

RPO
Red Meat Producers'
Organisation

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Red Meat Producers' Organisation

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South African agriculture is an interesting subject. Or perhaps not a subject, but rather an idea, a notion or even an observation. It is the one thing just about every South African can relate to or debate and philosophise about. Thinking about agriculture can evoke a sense of nostalgia, since farming has been a way of life for our fathers, grandfathers, and great-grandfathers. Many are envious of agriculturalists because land is equated to wealth, and everyone seems to want a piece. Very often agriculture is also an escape: I am tired of my job; I feel like quitting and taking up farming. For some it offers a respite: If only I could spend weekends on my own farm ...

In South Africa, our city dwellers are a step ahead of their first-world counterparts, because they know where their food comes from. Most people know someone who farms or once farmed. Agriculture is a revered industry and many South Africans want to claim a piece of it, sometimes physically, sometimes at an emotional level.

Then there are those who live agriculture every day. The producers, input suppliers, commodity buyers, researchers, technical officers, workers. The families still farming, those who couldn't continue farming, and those who know them. These are not people who refer to agriculture with envy or longing – they know its realities all too well. These are people who respect the immense power of nature and bend the knee every time – whether nature has supported their production practices or turned against it.

Those who make a daily living from agriculture understand the influence of market cycles and price volatility. Often, they know their livestock and crops better than they do some family members because, ultimately, these animals and crops are the lifeblood of their livelihoods. At night, they lie awake, strategising how to protect their enterprises from known and unknown threats. They sometimes ask themselves whether it's worth it. And yet, every morning, they rise and go about the task of producing food for the country and its people.

Agriculture in South Africa has two sides to it that are often worlds apart: the dream and the reality. The RPO's *Livestock Production Manual* is designed to support both. On the one hand, it is a source of information for livestock producers – those new to livestock production and who want to know as much as possible, and seasoned producers who need guidance to address a particular challenge. On the other hand, the manual also helps the dreamers realise their dreams. It may help some step confidently into farming, informed and prepared. For others, it may offer the clarity to pursue a different path altogether.

The *Livestock Production Manual* does not aim to provide all the information there is about livestock production, but rather to equip the reader with the necessary concepts, practical guidance, and reliable advice. Think of it as a tool to help realise your dream, a road map to a more informed reality, and a trusted resource on your farming journey. It is one piece of a much larger puzzle, but used wisely, it can help bring the bigger picture into focus.

DR FRIKKIE MARÉ
Chief executive officer
Red Meat Producers' Organisation

TABLE OF CONTENTS

AFMA
SAFE FEED FOR SAFE FOOD
Animal Feed Manufacturers Association

EMPOWERING THE FEED INDUSTRY

AFMA's Commitment to Sustainable Growth and Food Security

The Animal Feed Manufacturers Association (AFMA) is the official representative body for the South African feed industry, playing a vital role within the broader agricultural sector. Positioned in the food value chain, AFMA partners with government, regulatory bodies, parastatals, forums, academia, international agencies, and other related stakeholders in the value chain, to drive growth and innovation in the agricultural sector.

VISION

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STRATEGIC PILLARS

AFMA's activities are guided by four strategic pillars:

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Ensuring the **consistent** supply of **sufficient** and **affordable** animal feed for the production of meat, milk, eggs and fish.

Innovative animal nutrition for sustainable animal production

Using innovative nutritional strategies to produce **nutritious** animal feed in a **responsible** and sustainable way.

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1 THE RPO CODE OF BEST PRACTICE: IN A NUTSHELL

The RPO's *Code of Best Practice* for sustained and well-informed red meat production was compiled by Dr Heinz Meissner and serves as a guideline for red meat producers who strive to employ best practices and want to manage their farming enterprises in an economical, profitable and responsible manner. This chapter contains an edited summary of the practical aspects of the *Code*. Specific aspects of this code discussed in greater detail elsewhere in this manual, have been omitted from this summary of the *Code*.

1.1 INTRODUCTION

Farming is about a viable existence and sustainable profitability. It is also about a responsibility towards the next generation, as livestock producers are custodians of land. In this respect, their responsibility is towards natural resources and those who share in or are affected by the activities of the farming enterprise. Modern-day farming has evolved from a largely techno-economic viable enterprise into one that considers natural resources, biodiversity, ecosystems, animal welfare and social development, and global and consumer influences.

In the broader South African context, it also relates to a joint responsibility to support economic growth, inclusivity and employment through a social compact approach with government and other role-players, as has been described in the *Presidential Jobs Summit* (2018), the *South African Economic Reconstruction and Recovery Plan* (2021) (*ERRP*) and various sectoral master plans. The social compact approach for agriculture is guided by the *Agriculture and Agro-processing Master Plan* (2022) which should be regarded as both a source of viability for the sector and an important pillar of the country's overall economic recovery and reconstruction programme. From a red meat sector perspective, the operational functions of the Red Meat Producers' Organisation (RPO) should be aligned with the social compact approach, and the *Code of Best Practice* must commit the industry and producers to it.

1.2 THE *AGRICULTURE AND AGRO-PROCESSING MASTER PLAN (AAMP)*

The vision of the *AAMP* is to build a growing, equitable, inclusive, competitive, job-creating, low-carbon and sustainable agriculture and agro-processing sector, thereby striving towards a globally competitive sector, support market-oriented and inclusive production to develop rural economies, ensure food security, and create decent and inclusive employment and entrepreneurship opportunities for all participants in agriculture and agro-processing value chains. More specifically, these objectives are to:

- Improve food security in South Africa.
- Promote and accelerate sustainable transformation in the agriculture and agro-processing sectors.
- Improve access to local and export markets, which will require constant upgrades in the quality of supply to bolster South Africa's competitiveness.
- Enhance competitiveness and entrepreneurship opportunities through technological innovation, innovative financing models for black farmers, infrastructure construction and digitalisation.
- Create an effective farmer support system and agro-processing incentives.
- Create decent, growing and inclusive employment in addition to improved working conditions and fair wages in the sector.
- Improve the safety of the farming community and reduce livestock and crop theft, as well as farm attacks.
- Create a capable state and enabling policy environment.
- Enhance adaptability to climate change and promote the sustainable management of natural resources.

Members and officials of the RPO should commit to meeting the imperatives of the *ERRP* and *AAMP*, the latter as it pertains to the livestock value-chain cluster. The opportunities and commitments relating to the cluster are executed by Red Meat Industry Services (RMIS).

1.3 ENVIRONMENTAL INFLUENCES

1.3.1 Climate change

According to the accepted theory and observations regarding to increased greenhouse gas (GHG) emissions, all climate change projections indicate that southern Africa will generally become drier and hotter. This fact has been accepted by government and identified for priority planning in its *National Climate Change Response White Paper* (2011) and revised versions.

According to projects, average temperatures will rise by between 1,5 and 2°C by 2050. This will range from a mere 0,5°C at sea level to more than 3°C in the eastern parts of Namibia and western Botswana. Corresponding rainfall projections will, to a large extent, be influenced by El Niño/La Niña cycles in the Pacific Ocean. Nevertheless, it confirms

earlier predictions of a generally drier southern African region, except for the eastern interior where rainfall figures may be higher.

The most significant reduction in rainfall figures compared to the present are predicted for the eastern parts of Limpopo and Mpumalanga, the southwestern Cape and the Cape southern coast. Regarding the southwestern Cape, it is expected that water shortages may become more regular in future. Being a winter rainfall area the cold, wet spells moving in a north-eastern direction along the seaboard could decrease in these regions, resulting in less water available for livestock and the irrigation of winter pastures. Improved water storage and management will therefore be needed in these areas. The same applies to the interior and the Eastern Cape where the higher rainfall is expected to result in heavier downpours and greater run-off, with increased erosion as a secondary negative result.

Rising temperatures during certain times of the day will result in heat stress in cattle to which they are not adapted, resulting in lower productivity (growth, reproduction and milk), especially in less-adapted breeds. Results at Vaalharts revealed that even in well-managed beef herds the calving rate can decline by up to 60% in warm and dry years compared to normal years.

Animals will have to adapt their behaviour by becoming less active during the hotter times of the day, drink more water and graze at night rather than during the day. Producers must provide more shaded areas (for example by planting trees at water points) and water. Livestock grazing veld require approximately 4kg of water per kg of dry feed amid comfortable temperatures. This may increase by 50% or more in hot weather.

To calculate the daily water requirements of cattle, the large stock unit (LSU) used in grazing capacity estimates can be used as a point of departure. An LSU requires approximately 10kg of dry feed per day and therefore needs 10 × 4kg = 40kg litres of water per day. This could increase to between 50 and 60 litres in hot weather. A farm with 500 LSUs must therefore provide between 25 000 and 30 000 litres of water per day.

1.3.2 Greenhouse gas emissions

Livestock contributes significantly to global warming. This is ascribed to a comparatively high methane (CH_4) emission and a smaller but significant nitrous oxide (N_2O) emission. Although recently disputed, it is still accepted by the International Panel for Climate Change (IPCC) that CH_4 has a warming potential of about 28 times that of carbon dioxide (CO_2). The greatest danger of CH_4 is its impact on the formation of black carbon, an intense heating agent associated with the melting of large ice masses and the production of ozone in the troposphere. Nitrous oxide has a warming potential of 298 to 310 times that of CO_2. Apart from global warming, N_2O is the most important destroyer of the ozone layer in the atmosphere.

In South Africa, livestock's total enteric (resulting from rumen fermentation) contribution is about 1 330 Gigagram (Gg) per year. Of this, beef cattle enterprises contribute 63%, dairy cattle 10%, sheep 12,5%, and game 10,5%, with minor contributions from swine, poultry and ostrich farming operations. Direct N_2O emissions come mainly from manure and effluent systems in intensive swine, poultry and cattle systems, contributing 3Gg per year.

Greenhouse gas emissions from these production systems are at the higher end of the scale in developed countries and efforts should be made to mitigate these emissions, especially as CO_2 per kg product is expected to increase in the non-commercial sector. The fact is that each sector is required in terms of the IPCC directive to reduce its GHG emissions by approximately 20% by 2025.

Greenhouse gas emissions (carbon footprint) can be mitigated on-farm through:

- Improved production efficiency, which has the greatest potential of all direct methods.
- Planting cash crops using minimum till methods. The potential of these methods is good as very little carbon is released and less fertiliser (N_2O) is used.
- Saving on electricity, for example by using energy-saving bulbs and solar power for household and water provision.
- Optimising transport by travelling less and ensuring full loads during return trips. Use vehicles that are in a good working order and will emit less carbon (good fuel efficiency).
- Providing higher quality feed. Feed that contains grains, grain by-products, oilseeds, silage and green grazing will result in less CH_4 being produced during rumen fermentation per kg feed than in the case of less digestible feeds such as hay, mature grazing, and straw. Supplements and production licks will improve the digestibility of less digestible feeds and less CH_4 will be emitted per kg feed.
- Using home-grown feeds and by-products from the human food chain such as hominy chop, wheaten bran, defatted maize germ, and brewer's grains rather than purchased feed such as maize, and protein sources such as soya beans. Across the world maize and soya beans are associated with altered land-use practices (cultivation) and hence fewer carbon sequestration possibilities.
- Including additives such as oils and fats, probiotics and ionophores (such as monensin) in supplements and feeds. They tend to reduce CH_4 production during rumen fermentation, although very little. Ionophores, in turn, are regarded as antibiotics and are increasingly being omitted from formulations.
- Giving preference to well-adapted breeds and individual animals. They require less feed per kg product produced in the environment where they thrive and therefore produce less CH_4 per kg product. Selection programmes are increasingly used to identify individual animals (for example bulls) that produce less CH_4 than others.

Members of the RPO should commit to these responsibilities not only for their own benefit, but also in the best interest of the country.

1.4 PRODUCTION EFFICIENCY

Efficiency of production should be on par with that of competitors if the livestock sector is to hold its own in the domestic market and if better export is envisaged. In addition, if efficiency is optimal, then land use and resources will be optimised and the carbon and water footprint reduced. To improve efficiency all input variables (natural resources, financial arrangements, human resources, inputs, skills and other factors such as social concerns) need to be harnessed in support of biological measures in such a way as to ensure that the end product is the result of efficiency at all levels.

Production efficiency can be measured in various ways, ranging from biological measures and sustainable production to financial returns. The challenge is to achieve the potential maximum profit through optimal biological production efficiency while maintaining long-term sustainability. Biological efficiency is arguably the most critical factor as it can partially be controlled by the producer. Among others, it can be measured in percentage offtake and therefore dressing percentage.

The slaughter percentage in the commercial sector varies from 23 to 33% in the case of beef cattle, 29 to 35% for sheep and 33% for goats. Estimates regarding the small-scale and communal sector range from 8 to 25% for beef cattle, 2,3 to 36% for sheep and 10% for goats. Depending on the production system (either less or more intensive), benchmarks for beef cattle are 35 to 40%, for small stock producing primarily fibre 30 to 35%, and for small stock yielding multiple lambs and producing primarily meat, 60 to 70%. On average, the slaughter percentage, even in the commercial sector, is below target.

Primary reasons for low offtake are average to low reproductive rates, high mortality and erroneous herd/flock composition. For example, the national calving percentage in the commercial, small scale and communal categories was recently estimated (early 2020s) as 62, 48 and 35% respectively, mortalities at 5,8, 5,5 and 35,4% respectively, and percentage adult females in the herd 52, 49 and 25% respectively.

Study group results regarding commercial sheep farming indicate that in some areas the lambing percentage is 75 to 80 and the weaning percentage 65 to 70%. Neither is very good, although it needs to be considered that stock theft and predation have a significant impact. This high variation in reproduction is concerning. The stud industry records calving percentages of more than 90% and a lamb weaning rate of up to 140% under extensive conditions.

These manageable factors should become priority for livestock farmers, their supporting bodies and provincial extension officers. This growing trend among producers to not utilise a distinct calving season but to let cows calve through the year, not only results in some cows not calving every year but is cause for concern for other reasons as well:

- A lower annual calving percentage.
- The effect on genetic progress in terms of the culling programme for fertility and introducing replacement heifers with better genetics. With no clear annual records maintaining strict selection programmes are difficult, resulting in slower genetic progress.
- Since the nutritional requirements of cows in late gestation and lactation are much higher than cows that are not pregnant, the calving season is scheduled to coincide with the time of year (rainy season) when the rangeland can provide the maximum possible nutrients. In the absence of a distinct calving season, several cows will calve when the rangeland cannot provide in their needs, meaning supplementary feed will be required. This comes at an additional cost and will put some calves at risk as some cows will not ingest supplements. This will put stress on cows' reserves which may increase their susceptibility to disease, osteochondrosis and nutritional imbalances.
- Grazing capacity and stocking rates were designed based on the assumption that a herd's requirements are synchronised with what the rangeland can offer and with the time surplus animals are removed. The status quo is altered with calving throughout the year which means pressure on grazing, resulting in overstocking in the long term.
- In the context of the carbon footprint: More inputs go into parent stock (cows) and they in turn produce more CH_4. Because the annual reproductive rate is lower, offtake is lower, which will increase CH_4 emissions per kg meat produced.

1.5 PROTECTION OF NATURAL RESOURCES

1.5.1 Biodiversity and ecosystems

Maintaining biodiversity of flora and fauna species and the associated ecosystems have become a global concern as the successful functioning, resilience and sustainable utilisation of natural resources depend on sufficient genetic diversity and healthy ecosystems. To support imperatives in this regard and provide directives, several pieces of legislation have been promulgated.

Strategies that have bearing on livestock producers include:

a) Conserving representative samples of species and habitat.
b) Conserving the ecological and evolutionary processes that allow biodiversity to persist over time and to set biodiversity targets.
c) Linking biodiversity and socio-economic development. One principle is that co-operation is needed between production sectors and private and communal landowners to maintain biodiversity, to prevent the loss of threatened habitat and species and to protect ecosystem functioning.
d) Focussing emergency action on threatened ecosystems to prevent further loss of ecosystem functioning. Since threatened ecosystems and land degradation are often found in farming and communal areas, minimising these could be supported by, among others, stewardship by commercial producers and the emerging and communal sectors.

Clearly, there is a great responsibility on all RPO members as well as RMIS as the primary functionary of initiatives.

Globally there are concerns regarding the loss of diversity in genetic resources because of injudicious crossbreeding and replacement. This coincides with a growing awareness of the real value of adapted breeds and their impact on natural vegetation. This has given rise to greater efforts to maintain genetic diversity and created a profitable market for South African producers of such breeds and composites. The demand is expected to increase along with growing interest in sequenced genomes and transgenic or cloned animals to exploit favourable genes for increased productivity and quality livestock products.

Conserving animal genetic material is more difficult than in the case of plants where seed is easily stored. This is because semen and ova are expensive to store. Therefore, sustainable utilisation of existing animals themselves remains the primary option, placing a strong biodiversity perspective on the responsibilities of seedstock suppliers.

For that purpose and to ensure that livestock farmers enjoy a competitive advantage in the international market, guarantees on lineage and genetic soundness will have to be provided. This will only be successful if breed societies, registering authorities, producer associations, support services, service providers and traders of genetic material work together to provide the necessary certification on positive identification, pedigrees (by for example regular randomised parentage testing) and performance.

Regarding the protection of floral biodiversity and ecosystems, aspects such as degradation of natural vegetation,

loss of underlying soils, poor water retention because of wetland drainage or damage, alien plant invasion and bush encroachment are cause for concern, although there are good examples to the contrary. To improve or reverse the condition of the floral biodiversity and ecosystem protection, a holistic and inclusive management approach is required with dedication by government, supporting non-governmental organisations (NGOs), agricultural associations and the producer as the custodian of the land. Functionaries and members of the RPO through RMIS must commit to this responsibility.

The producer's committed approach to rangeland protection and restoration (supported by appropriate expertise) should be to:

- Restore the loss of basal cover.
- Restore the loss of key climax and palatable species.
- Combat bush encroachment and the spread of alien species.
- Employ stocking rates aligned with regularly monitored grazing capacity statistics.
- Prevent soil erosion and recover eroded areas through natural and mechanical means.

1.5.2 Rangeland management

Since rangeland condition largely determines the productivity and well-being of the ecosystem or biome, the rule of thumb is the healthier the rangeland, the more productive and sustainable livestock production will be.

Rangeland in a healthy state limits variation in seasonal induced fodder supply, it maximises fodder production per rainfall unit and the number of palatable species, it prevents soil erosion and water run-off, and it maximises carbon sequestration. Rangeland in a healthy condition is also to an extent an effective antipode to droughts. To the contrary, rangeland in a poor state leads to overgrazing, bush encroachment, invasion of alien species, and soil erosion.

Of all these measures, stocking rate has the highest correlation with the biological output of livestock products, economic return and the long-term condition of the rangeland. Although the rangeland management system used is roughly a function of both grazing capacity and stocking rate, the efficacy of the stocking rate applied is mainly determined by whether the management system allows for alternating comparatively short grazing cycles and long resting periods.

The better the condition of the veld, the better and more sustainable livestock production will be.

1.5.3 Fodder supply

Where the potential of vegetation resources is limited and/or overgrazed the fodder supply should be supported by cultivated species. Drought tolerant crops should be established in areas susceptible to seasonal, annual and longer-term droughts. In cash crop areas, crop residues provide a valuable supplementary fodder source whereas various high potential grass and legume species are considerations in high rainfall areas and the southern and eastern seaboard.

As part of regenerative crop production practices, cover crops are established by way of intercropping, and the cover crop itself is a high-quality fodder which can be grazed as well. The principle is to support livestock productivity when the rangeland

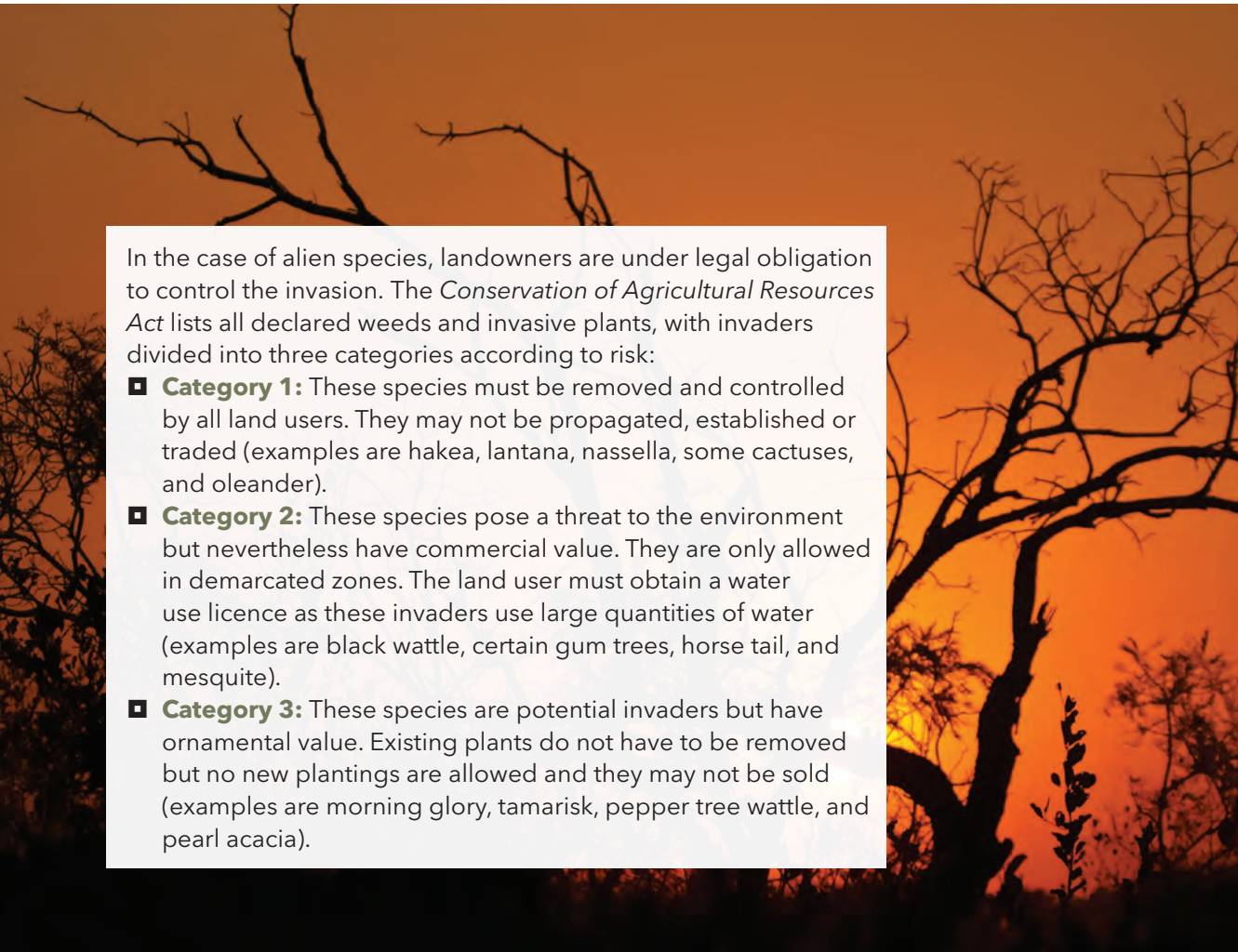
fodder supply is limited and/or to support rangeland resting phases by removing livestock. A word of caution though: Whereas cultivated pastures offer the opportunity to increase fodder supply and potential overall grazing capacity, unwise implementation by increasing livestock numbers can exacerbate degradation of the natural vegetation.

This can occur when the animals are supplemented by the cultivated resource during winter and put to pasture in summer without reducing numbers or following regenerative management practices.

The ratio between supplementary fodder sources and fodder supply from the rangeland, should therefore be carefully and holistically assessed before deciding on the introduction of cultivated pastures. Producers should consult grazing specialists and sound literature regarding suitable grazing species.

1.5.4 Bush encroachment and alien species

Bush encroachment and invasion by alien species both lead to the destruction of habitat and a reduction of the resilience, productivity and water holding capacity of rangelands, biomes and ecosystems. Landowners should be committed to controlling the invasion of woody species by fire, or mechanical and chemical means, depending on advice from rangeland management experts. Biological control methods are also available.



In the case of alien species, landowners are under legal obligation to control the invasion. The *Conservation of Agricultural Resources Act* lists all declared weeds and invasive plants, with invaders divided into three categories according to risk:

- **Category 1:** These species must be removed and controlled by all land users. They may not be propagated, established or traded (examples are hakea, lantana, nassella, some cactuses, and oleander).
- **Category 2:** These species pose a threat to the environment but nevertheless have commercial value. They are only allowed in demarcated zones. The land user must obtain a water use licence as these invaders use large quantities of water (examples are black wattle, certain gum trees, horse tail, and mesquite).
- **Category 3:** These species are potential invaders but have ornamental value. Existing plants do not have to be removed but no new plantings are allowed and they may not be sold (examples are morning glory, tamarisk, pepper tree wattle, and pearl acacia).

1.5.5 Water management

Agriculture consumes about 75% of the rainfall in South Africa. Of this, 60% is utilised by natural vegetation, 12% by dryland crop production, and 3% by irrigation. The natural vegetation (rangeland) and non-irrigated crop production use only so-called green water, which is rainwater stored in the soil after precipitation. It is called green water because only green plants growing in the soil utilise it.

In terms of food production, green water is used to produce meat and other animal produce under extensive grazing conditions on natural rangeland. Rangelands by and large do not use so-called blue water, which is run-off water to streams, dams and other storage infrastructure, or water stored in underground aquifers and normally recovered from boreholes. Blue water is primarily available for the water requirements of livestock. In terms of management, the objective should be to optimise both green and blue water on the farm.

Model predictions show that climate change will result in a somewhat drier country. What is important from a management point of view is the frequency and intensity of precipitation and seasonal shifts. Thunder activity is expected to increase resulting in short, heavy downpours. This will mean more water flowing away unutilised and higher evaporation due to higher temperatures.

The net effect could be less effective rainfall, even if rainfall increases, unless rain-fed water (both green and blue water) is better managed. The following measures will be crucial:

- Catchment areas on farm becoming storage areas.
- Mechanical means such as weir construction, and natural methods such as creating wetlands (*vlei* or marshes) in catchment areas by planting reeds and tough grasses which are adapted to the specific region.
- Good plant cover in rangelands that captures rainwater which otherwise would have run off. This implies that blue water also then becomes green water.
- In mixed farming systems where livestock producers also produce crops, minimum tillage should become the norm rather than the exception. Minimum till ensures more organic matter leading to better water capture and usage, even more so if cover crops are used.

Apart from quantity, the quality of water on farms is also important. The water quality standards for human and animal consumption are available from the *South African National Standard for Drinking Water SANS 241*.

Water should be tested regularly for microbiological and chemical contents to ensure that it complies with the specifications in SANS 241. All water sources such as borehole, river and canal water should be tested. Where water is chlorinated on site, a routine checking procedure must be implemented. Storage tanks and water reservoirs must be covered to prevent contamination by birds, rodents, organic and inorganic matter. Also, the air vents to these tanks and reservoirs must be insect and rodent proof.

In cases where there may be effluent, such as from an on-farm feedlot, it must be appropriately managed to ensure effective disposal with no contamination of water sources. If the effluent is applied

to pasture, there must be a lapse of at least 21 days between application and grazing or harvesting of the pasture. In addition, if the effluent is collected and spray-irrigated from a storage system, the homestead and vicinity should not be exposed to spray drift.

Storage facilities for oil, silage spray liquors, fertilisers and other polluting substances must be in a safe place and precautions must be taken to ensure that accidents do not result in the pollution of farm water supplies.

1.5.6 Pollution

The following guidelines may assist producers in managing solid waste to prevent contamination of products (meat), animals and the environment:

- Animals must be kept away from areas where effluent/manure or waste is stored, to minimise exposure.
- Animals should not be exposed to human waste or any other waste likely to contain pathogens that can pose a risk to human health.
- Special attention and care should be given to pest control in waste collection areas.
- Facilities for the storage of waste should be designed to preclude the entry and harbouring of pests, and to avoid the contamination of food, potable water, equipment, buildings and roadways on the premises.
- It is advisable to have clearly demarcated and marked waste containers for the disposal of waste. They should be designed in such a way that they cannot be mistaken for food containers. Skips or containers that contain waste material should be covered and emptied at least once a week, or more frequently, to minimise the risk of infestation.
- Combustible waste, if incinerated, must be burned in an area that is located at an adequate distance from the homestead and farm buildings, to avoid a fire hazard, contamination of the air or the environment in general.
- Hazardous waste may include pesticides, cleaning chemical containers, medicine containers and needles. Such waste should be disposed of in a manner that will not harm humans or animals or contaminate the environment.
- Needles used during vaccination or other injections are often simply discarded. However, the regulation states clearly that needles must be stored in a dedicated and clearly marked container or a strong plastic container with a tight-fitting lid and disposed of at a veterinary office or clinic.
- All other hazardous substances must be disposed of in an environmentally appropriate manner after consultation with the relevant health authorities, and in accordance with the requirements of the relevant national legislation.

Meat producers should consult the *Code of Practice for Milk Producers* compiled by the Dairy Standard Agency if they also produce milk and other food products on the farm.

1.6 ANIMAL HEALTH AND WELLBEING

As with other disciplines, this section is guided by several laws and pieces of legislation. In addition to legislation, certain codes of practice relevant to the RPO were developed by the Livestock Welfare Coordinating Committee (LWCC) for the handling and transport of animals, feedlots, and the handling of livestock at auctions, shows and vending sites. These codes should be read in conjunction with the *Animal Protection Act, 1962 (Act 71 of 1962)* and a supporting document, the *Manual of Animal Care and Use* compiled by the South African Veterinary Foundation. The manual was developed to consolidate all pieces of legislation on animal care.

Animal welfare can be defined as a reflection of people's concern for the humane treatment of animals. Internationally, therefore, the humane treatment of animals is guided by a set of principles when it comes to the care and use of animals, such as with livestock on farms, in transit, or at auctions and feedlots. Those with relevance to RPO are the following:

- Realising that there is a critical relationship between animal health and animal welfare.
- The recognised 'five freedoms' provide valuable guidance in animal welfare management. These are freedom from hunger, thirst and malnutrition; freedom from fear and distress; freedom from physical and thermal discomfort; freedom from pain, injury and disease; and freedom to express normal patterns of behaviour.
- Animal production carries with it a duty to ensure the welfare of such animals to the greatest extent practical.
- Improvements in farm animal (livestock) care can often improve productivity and lead to economic benefits.

These basic principles are not difficult to associate with; in fact, they reflect the love of farmers for their livestock and if adhered to can benefit their balance statements. To that effect there are many studies confirming this, such as the animal that does not bruise when in transit because of well-designed transport equipment; quality and shelf life of meat improve with humane handling practices; losses are minimised and efficiencies of production improved if stress and disease are controlled.

RPO members should study the *Code of Practice of Handling and Transport of Livestock* since they are regularly confronted with handling and transport of stock. Although the *Code for Feedlots* was compiled for commercial operations, some farmers do feed their weaned calves, lambs or kids on farm, which make the guidelines of feedlot construction and procedures handy. The *Code of Practice for the*

Handling of Livestock at Shows, Auctions and Vending Sites was compiled for the staff responsible for such an event, but it provides valuable norms and procedures for farmers transporting livestock to and from and housing them at the premises.

Important aspects such as water, nutrition, animal diseases, biosecurity, handling facilities and more are discussed elsewhere in this manual.

1.7 DAMAGE-CAUSING ANIMALS (PREDATORS)

Predators such as jackal, leopard and caracal in natural systems or reserves are important in controlling population numbers and removing old and sick animals and decaying carcasses. Unfortunately, calves and small stock are easy targets resulting in enormous losses per year. This obviously has major consequences for the agricultural gross domestic product (GDP), export of wool and mohair, and domestic meat supply.

These predators are territorial, which implies that if killed other dominant ones will simply fill the vacuum. A second principle is that not all predators by preference prey on calves and small stock; most will only do so if their natural prey such as small antelope, dassies, hares, birds and lizards become scarce. Thus, a balanced approach to the problem with selective killing (only culprits), collaborating with neighbours, predator experts and adjacent reserves, and restoration of the ecosystem and natural prey on farms is the only long-term solution.

If killing is truly necessary, it must be quick and humane to prevent suffering – preferably by using qualified hunters. Killing is not the only option; producers can use 'natural shepherds' (for example donkeys, alpacas, and dogs), pens, predator proof fencing or livestock protecting collars, provided the methods employed have been cleared with the authorities.

Methods which cause morally indefensible suffering to predators, such as poisoning, hunting dogs and traps are neither endorsed nor condoned. Best practices for predator management and SOPs are discussed in Addendum 2 to this code. A further document is provided by the Griffon Poison Information Centre.

Predation management has been established under Predation Management SA (PMSA) on which all role-players are represented. The PMSA provides a platform to commodity organisations, aimed at reducing losses incurred because of predation by means of ecologically and ethically acceptable methods which protect the biodiversity of the country.

1.8 STOCK THEFT

Crime, including stock theft, has reached unacceptable high levels in the farming and rural communities. A study in the Eastern Cape showed that losses due to stock theft amounted to about 20% of the GDP of agriculture in the province. Of particular concern is that emerging/communal farms are as vulnerable as the commercial sector.

Crime has direct bearing on the emotional, economic and social well-being of farming and associated communities, and it also affects the economic viability of towns since their businesses are largely farmer dependent. Effective measures to protect and eliminate crime are the democratic right of citizens. It is also imperative if inroads are to be made in the goals of reducing poverty, promoting upliftment, empowerment, job creation and sustainable rural development through livestock and other agricultural means. Protection requires effective communication, prevention measures

and cooperation between police, the responsible government departments, farmer support bodies, farmers, farm workers and even the community at large. To that effect knowledge implies empowerment. Therefore, it is important for producers to study the relevant laws and to know the information the authorities will require from a reporting statement.

These laws are:

- The *Stock Theft Act, 1959 (Act 57 of 1959)*.
- The *Criminal Procedure Act, 1977 (Act 51 of 1977)*.
- The *Animal Identification Act, 2002 (Act 6 of 2002)*.
- The *Fencing Act, 1963 (Act 31 of 1963)*.

1.9 LIVELIHOOD AND WELL-BEING OF EMPLOYEES

The overriding principle is that farmers need to ensure that the rights and well-being of farm workers and their families are upheld and that they contribute to the social and economic development of the local community and those on the periphery. Various laws regulate the welfare of farm workers and other staff in South Africa. These laws and other good labour practices are discussed elsewhere in this manual. RPO members should commit to the following:

- Comply with the conditions legislated for fair labour practices.
- Contribute to employee unemployment benefits.
- Contribute to the skills development of employees.
- Provide for compensation of death or disablement resulting from occupational activities.
- Provide for the safety and health of the persons at work.
- Uphold the rights of labour tenants and farm occupiers to reside on land and to acquire land where appropriate.
- Ensure that land on the farm is available for recreational use.
- Participate in actions towards establishment of a sustainable local economy.
- One way of participating in such actions is to adopt a policy of preferential employment of residents from the local community or from labour tenants on the farm. Applicable research results suggest that agricultural growth and efficient management of natural resources are dependent on the political, legal and administrative capabilities of rural communities to determine their own future and to protect their natural resources and other economic interests. Commitments hereto should be read together with obligations discussed in the recommendations of the *AAMP*, and RPO and NERPO goals and objectives.

The umbrella principle is that farmers are the mainstay of the economy of towns, townships and the surrounding rural environment, and they have the knowledge and skills to support development towards a viable and sustainable local economy.

1.10 SAFE, HIGH-QUALITY ANIMAL PRODUCTS FOR THE CONSUMER

Access to safe and healthy food is a fundamental human right and protected in the *Constitution of South Africa*. As such, this puts a responsibility and commitment on all concerned in the supply chain (farmers, processors and retailers) to meet these obligations to consumers. The producer's obligation and commitment in this regard really comes down to all principles and measures discussed here: It is about everything captured in conservation of ecosystems, protection of the natural resource base, animal welfare measures and training and social development of employees.

The supply of safe and healthy (quality) livestock products is not about an organic versus a conventional farming system, or intensive versus extensive practices, as has been regularly argued in the popular media. Rather it is about control of risks; all systems have risks which the farmer needs to be aware of and manage meticulously. Risk control becomes effective when a traceability and audit system is implemented. It requires identification of all animals by tattooing and the keeping of production records.

To comply, producers are advised to implement biosecurity measures, have a policy on visitors, draw up a written veterinary health plan with time frames, have regular recorded visits and reports from a veterinarian and have recorded assistance from a nutritionist when doing home mixing.

On-farm training and skills development should emphasise the reasons and actions for these measures to limit risk and ensure safe products, thereby supporting the socio-economic well-being of both employer and employee. All these measures can be accommodated and put into practice by implementing an integrated farm management plan.

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TWO ACTIVE INGREDIENTS IN ONE DRUM – FOR THE CONTROL OF A WIDE SPECTRUM OF SPECIES

WHAT IS BUNDU® SC?

A soil-applied liquid herbicide with dye and long residual activity in the soil. **BUNDU® SC** is suitable for the control of undesirable tree and shrub species as well as annual and perennial weeds in uncultivated areas such as road shoulders and to protect fences against fires.

WHY BUNDU® SC?

- **BUNDU® SC** is effective against a broad spectrum of woody species.
- Rain is required to activate **BUNDU® SC** after application, which ideally should occur just before or shortly after the start of the rainy season.
- The pro-life components in the soil are due to microbial activity.

BUNDU® SC IS KNOWN FOR:

- Control of unwanted woody plants in pastures.
- Control of nuisance plant growth in:
- Road reserves.
- Along railway lines.
- Under power lines.
- Long-term weed control at fences.

ACTIVE INGREDIENT

Bromacil (substituted uracil) 250 g/ℓ
Tebutiuron (urea compound) 250 g/ℓ

MODE OF ACTION

BUNDU® SC is only absorbable by roots and therefore requires rain to be activated. After absorption, it inhibits photosynthesis in treated plants and the leaves of treated plants will turn yellow. Treated trees will defoliate repeatedly before dying.

DIRECTIONS FOR USE

Study the product label before use. Apply just before or during the rainy season. Treatments will only be effective after sufficient rain has fallen to allow the product to seep into the root zone. Trees may take up to a year or more to die and in some cases a second application may be necessary 24 months after the initial treatment.

NOTE: BUNDU® SC should not be applied to the root zone of desired plants.

BUNDU® SC | REG. NO. L7517 ACT 36/1947 | HRAC HERBICIDE GROUP CODE: 15 | ACTIVE INGREDIENT: BROMACIL (SUBSTITUTED URACIL) 250 G/ℓ, TEBUTHIURON (UREA COMPOUND) 250 G/ℓ | **SPRINGBOK®** | REG. NO. L6719 ACT 36/1947 | ACTIVE INGREDIENT: GLYPHOSATE 360G/ℓ | **KILO MAX®** | REG. NO. L 8310 ACT NO. 36 OF 1947 | ACTIVE INGREDIENT: GLYPHOSATE 700 G.E/KG, GLYPHOSATE SODIUM SALT 791 G/KG | HARMFUL | WARNINGS: HARMFUL IF SWALLOWED. CAUSES SKIN IRRITATION. CAUSES SERIOUS EYE IRRITATION. MAY CAUSE RESPIRATORY IRRITATION. MAY CAUSE DAMAGE TO THE KIDNEYS THROUGH PROLONGED OR REPEATED ORAL EXPOSURE. VERY TOXIC TO AQUATIC LIFE. | REGISTRATION HOLDER: UPL SOUTH AFRICA (PTY) LTD CO. REG. NO.: 2009/019713/07, 7 SUNBURY OFFICE PARK, OFF DOUGLAS SAUNDERS DRIVE, LA LUCIA RIDGE, SOUTH AFRICA. 4019, TEL: 031 514 5600

DOSAGE

TREE AND SHRUB MANAGEMENT

Dosages, as well as the degree of dilution with water, are determined by the tree species and tree size. Study the label carefully before use.

NON-CROP USES

Depending on the clay content of the soil, weed spectrum and the desired period of control, use 8 - 24ℓ / hectare. For small areas, apply 100 - 240mℓ per 100m². For an improved knockdown action, mix with **SPRINGBOK®** or **KILO MAX®** (foliar absorbed herbicides).

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2 BUSINESS ASPECTS OF FARMING

2.1 BUSINESS ENTITIES FOR FARMING ENTERPRISES

Producers often wonder what business entity is best for a farming enterprise. There are many factors that come into play and while one entity and business structure is suitable for producer A, it may not be the case for producer B.

2.1.1 Sole proprietorship

The most common business form is where a producer holds the farm in his/her personal capacity. This means the farm is registered in his/her name at the deeds office, and the business is also operated in his/her personal name. This is often the case where a farm has been inherited from a family member.

The problem with this model is the lack of separation between the property, farm, and business operations. Should the farming business go bankrupt, the producer runs the risk of the farm (land) also being lost in order to pay creditors. Upon the death of the individual, his/her deceased estate will pay both estate and capital gains tax on the value of the farm and the farming operation, which often leads to a forced sale of the farm due to a lack of liquidity to pay all debts and taxes.

Many producers in South Africa find themselves in this situation. A producer is sometimes advised to operate the farm in their own name in order to take advantage of the lower tax rates offered to small businesses. However, what is gained here is lost once wealth taxes such as estate and capital gains tax are levied upon their death.

The older way of doing things

Another trend is for the producer to transfer his/her farm to a family trust and to continue operating the farming operation in his/her personal name. There are even instances where the farming operation is operated within the trust.

The positive aspect of this structure is that the capital growth of the farm's market value is shifted to the trust and falls outside of his/her personal estate. This saves on future estate and capital gains tax levied on growth. However, transferring the farm was probably done on a loan account basis, meaning the trust still owes the producer the purchase price of the farm. This amount remains an asset in the estate, and estate duties, and in some cases capital gains tax, must be paid.

Section 7C of the *Income Tax Act, 1962 (Act 58 of 1962)* taxes these loans if they are interest-free. Another positive aspect of this model is the separation of ownership of the property and farming. This way the producer can rent the farm from the trust and deduct the rent as an expense from farming profits. However, this does not account for the fact that the trust will pay the highest possible income tax rate, namely 45% from rand one.

In the past, close corporations were a popular option, mainly due to cheaper bookkeeping and set-up costs. However, since the new *Companies Act, 2008 (Act 71 of 2008)* came into effect, no new close corporations can be established, and a private company now offers basically the same benefits as a close corporation.

2.1.2 Private company

One common and effective option for running a farm is using a private company or (Pty) Ltd. This structure offers some advantages, including clear legal separation between personal and business affairs, easier access to financing, and greater credibility with customers and suppliers.

A company is a legal entity in its own right. This means it can own assets, enter into contracts, and be liable for debts separately from the owner. This separation helps protect the owner's personal assets should the business experience financial trouble.

When it comes to taxes, companies in South Africa pay a flat corporate income tax rate of 27%. This is often lower than the personal tax rate for high-income individuals. If the company is classified as a small business corporation (SBC) and meets certain conditions (such as generating a gross income below R20 million), it may qualify for even lower tax rates on its first few hundred thousand rand profit.

In addition, if your farming business exports goods or sells zero-rated items such as basic foodstuffs, the company may be able to register for VAT (value added tax) and reclaim it on certain expenses.

Keeping accurate financial records is important for tax purposes and legal compliance. South Africa's *Companies Act* also requires companies to file annual returns and keep up-to-date records of directors, finances, and more.

Using a company to operate your farming business in South Africa can provide legal protection, potential tax savings, and more opportunities for growth. However, it is important to comply with legal and tax rules to fully benefit from this structure. Always consult an accountant or legal advisor before getting started.

2.1.3 Trusts

A trust can briefly be explained as follows: The founder gives assets to people he/she trusts, along with guidelines on how these assets should be managed and who should benefit from it.

Why a trust?

- Your assets are protected from your creditors.
- Independent trustees ensure that your wishes are carried out.
- Trusts offer estate tax planning benefits, as estate tax is avoided as long as the assets are in a trust.
- Your taxable income can be distributed to income beneficiaries. The income is then taxed at the beneficiaries' own tax rates and not at 45%.

Four components are required for a trust: a founder, trustees, a trust deed, and beneficiaries.

2.1.3.1 Who can set up a trust?

Anyone, provided they have the necessary capital to cover the legal fees and annual cost of regulatory compliance. A person

who wants to set up a trust can do it themselves or use a professional service provider such as a financial advisory firm, attorney, or accounting practice.

The costs vary from one service provider to the next, but one should not necessarily look for the cheapest deal. Instead, consider the value of the service provided.

2.1.3.2 Types of trusts

Several types of trusts exist, and not all can be treated the same.

An ***inter vivos* trust** is an agreement or contract between its settlor and trustees, in terms of which the latter undertake to manage the trust assets for the benefit of the beneficiaries. The purpose of an *inter vivos* trust is to place growth assets in it for inheritance purposes and not for the purpose of selling them, as selling an asset from a trust will result in double the capital gains tax compared to an asset sold by an individual.

In the case of a **discretionary trust**, the trustees have full discretion to decide which and when to distribute benefits to which beneficiaries. The beneficiaries of a discretionary trust therefore have no claim to any benefits.

In the case of a **vested trust**, the trustees only manage the assets in an administrative capacity on behalf of the beneficiaries. This type of trust is usually used to protect the interests of a minor child or a person who is mentally challenged or disabled.

2.1.3.3 Duties of trustees

South African law does not consider trusts to be a separate legal entity. This means that a trust deed is in effect a management contract between the settlor and trustees. This document determines who the income and capital beneficiaries are (i.e. who can use the trust's assets or receive money from it).

Trustees, of whom there must always be at least one independent trustee not related to the settlor or beneficiaries, must perform their duties as set out in the trust deed and manage the assets in the trust for the benefit of the beneficiaries. Trustees must keep accurate accounting records of all funds received and paid, as well as minutes of meetings.

2.1.4 Options for modern-day circumstances

A company structure combined with a family trust is likely the best entity to meet a producer's objectives. If the farm is held by a company, and the business in another company, renting the farm can create a tax deduction in the trading company, while the farm holding company will be taxed on the rental income after capital allowances.

If the shares in the companies are held by a family trust, the farm and farming enterprise effectively fall outside the personal estate of the producer, resulting in an estate and capital gains tax saving. It further safeguards the farmland when the farming business is in financial trouble, although financing with financial institutions might water this advantage down due to, for example, mortgage security over the farm.

Separating the farm and business enterprise offers a form of protection if a farm is expropriated without compensation or for less than market value. A long-term notarial lease, for example 50 years, is entered into between the company that owns the farm and the trading company and is registered against the title deed of the farm. If expropriated, the rights of third parties such as a tenant or the trading company must be respected, such as them being able to remain on the farm for the remaining period of the lease.

This business structure enables the producer to externalise ownership of the farm and the farming business to jurisdictions such as Mauritius, the Seychelles, or others, thereby acquiring

the status of a foreign investor. This provides the producer with the opportunity to secure an award in international tribunals as compensation for the expropriation of his/her farm, which can be enforced against the South African State.

SOURCES
- Robbertse, G. 2023. The right business entity for the right purpose.
- De Klerk, J. 2013. Trusts as besigheidsvorm / Die kwessie van geldigheid.
- Van Eden, F. 2019. Bewaar jou nalatenskap met 'n trust.
- Lombard, M. 2025. Private companies.

2.2 TAX

2.2.1 Legislation and taxation

A farm is a business and for a producer to run his business successfully, he needs to be knowledgeable regarding all aspects of the business. One area of a business that may be a grey area for most producers is taxation. In South Africa, taxation is regulated by a number of laws. Of these, the *Income Tax Act*, the *Value Added Tax Act, 1991 (Act 89 of 1991)* (the *VAT Act*), and the *Customs and Excise Act, 1964 (Act 91 of 1964)* are the most important, although there are other laws that also relate to taxation.

Taxes that can affect a farming enterprise include **income tax** if it is operated in a separate entity, as well as personal income tax on the individual. The taxable income of the farm includes all income generated by the farming activities, including renting out land, livestock, and crop yields. However, taxable income is not limited to these activities.

Value added tax (VAT) is an indirect tax collected by the South African Revenue Service (SARS) by levying taxes on certain goods. There are two VAT rates that can affect farming, namely standard-rated supplies, and zero-rated supplies. It will also be beneficial for farmers to know which supplies are exempt from VAT.

Capital gains tax, which also forms part of a person's income tax, includes capital gains and losses when an asset is sold. It has an impact on the producer as an individual, as well as the company or trust in which the farm business is registered.

Estate duties are another important form of tax that has a major impact on financial planning. Estate duties are levied on the estate of a deceased person and requires that the beneficiaries be held responsible for paying the tax. Estate planning is extremely important to ensure that people pay the least amount of tax possible and that the beneficiaries' burden is as light as possible.

Other taxes and levies

Employee tax or the pay as you earn (PAYE) system is a withholding tax that must be deducted from an employee's remuneration. The deduction is made by the employer and is determined according to tables issued by SARS. Annexure four to the *Income Tax Act* determines that an employer must apply for registration with SARS within 14 days of becoming an employer unless none of his/her employees are liable for normal income tax.

The skills development levy (SDL) is a compulsory levy scheme aimed at funding education and training as contemplated in the *Skills Development Levy Act, 1999 (Act 9 of 1999)*. In terms of the *SDL Act*, where an employer is liable to pay the levy, the employer must register with SARS as an employer. An employer is not obligated to register as an employer for SDL purposes under certain conditions.

Unemployment Insurance Fund contributions (UIF) are compulsory in terms of the *Unemployment Insurance Fund Act, 2001 (Act 63 of 2001)* to fund unemployment benefits. In terms of the *UIF Act*, an employer must register with SARS or the UIF office to pay over this contribution.

In terms of the *Income Tax, UIF* and *SDL Acts*, every employer must keep a register of remuneration of each employee and his/her PAYE, UIF and SDL, and keep it for a period of five years from the date of the last entry.

EMP, UIF contributions and SDL levies must be remitted to SARS within seven days of the end of the month during which the amount was deducted. If the seventh day of the month falls on a Saturday, Sunday or public holiday, the payment must be made no later than the business day preceding that day. Interest and penalties may be levied on overdue payments, outstanding amounts, or failure to recover and/or pay over the amounts in question.

Every employer registered with SARS must complete a reconciliation every two years. The income tax numbers of employees must be indicated on their tax certificates (IRP5/IB3).

SOURCES
- Lombard, M and Nieuwoudt, S. 2016. Everything producers need to know about tax.
- Nel, G and Rheeder, H. 2014. Kyk die belasting-gaarder in die oë.

2.2.2 The tax year

The tax year officially starts on 1 March each year and ends on the last day of February in the following year. Tax payments and return submissions must be made on time to prevent SARS from levying penalties and interest on overdue payments.

The *Income Tax Act* also provides for a financial year that differs from the official one. Before 1 July 2002, most individual producers operated with a tax year that ended on 28/29 February, but some individual producers who started farming before 30 June 1965 had tax years ending 30 June and were exempt from paying provisional tax. *SARS Interpretation Note 19 (Edition 4)* of 15 February 2016 provides more details regarding the requirements and operation of financial years that end on a date other than 28/29 February.

Provisional tax

All persons who earn an income other than a salary income must register for provisional tax. All farms should therefore register for provisional tax. Provisional tax simply entails the manner in which income tax is paid by means of two provisional payments during the year, as well as a third voluntary payment.

Provisional tax is calculated by estimating what the farm's income for the year will be and then calculating the tax on that (it is therefore a tax estimate for the year). The total amount is then paid throughout the year in the form of provisional payments. SARS prefers an estimate that is 80 to 90% accurate, but in the case of an unforeseen event and an inaccurate estimate, a third voluntary payment can be made.

The first payment must occur on the last day of August of the tax year in question, while the second payment must be made on the last day of February. The third voluntary payment is an opportunity to pay

additional tax if the taxpayer suspects that the estimate of the farm's taxable income was inaccurate.

If the taxable income is more than R1 million, SARS requires the estimate of taxable income to be at least 80% of the actual taxable income. In cases where the taxable income is less than R1 million, a 90% accurate estimate is required. Should the estimate not fall within the required limits, a discretionary penalty of 20% may be imposed on the difference between the estimated and the actual income.

Applicable VAT provisions

Section 27(1) of the *VAT Act* provides for the various categories into which sellers fall with regard to VAT. Category D is for businesses that comprise exclusively of agricultural, livestock or other farming activities, with a tax period of six months ending on the last day of February and August.

This category also provides for a written application to the commissioner to approve a tax period ending in another month or months.

SOURCES
- Krause, F. 2017. Tax year vs financial year.
- Lombard, M. 2014. The *VAT Act* and the farmer.

DID YOU KNOW?

SARS can audit any business at any time and even without prior notice. The tax collector's system uses data analytics to detect irregularities and unusual activity. If you are selected for a tax audit, the business has 21 days to provide supporting documentation. So make sure your records and documentation are accurate and always in order.

2.2.3 Tax returns and claims

Some important dates need to be diarised when doing year-end and submitting your tax returns (February):

- Provisional tax payment – 28/29 February.
- Last day to file income tax returns for companies and close corporations (CCs) – 28/29 February.
- Last day to file IRP5 reconciliations – 31 May.
- Last day to finalise financial statements – 31 August.
- Provisional tax payment – 31 August.
- Provisional tax payment (voluntary) – end of September.

The following are important records needed for year-end and tax returns. Supporting documents are any document from a third party, such as a car dealership, which provides written evidence that a transaction did in fact take place. Examples are tax invoices, facility letters, receipts, contracts, and the like.

Assets

- ◘ Did you purchase any new property, facility, or equipment during the year?
- ◘ Did you trade in/sell any new property, facility, or equipment during the year?
- ◘ Were any of your assets stolen during the year? Those losses must be accounted for in the financial statements.

Livestock

- ◘ Did you purchase any new livestock during the year?
- ◘ Have you made a note to do a stock count at year-end to determine how many livestock you own?
- ◘ Did you sell any livestock during the year?
- ◘ Did you keep record of livestock increases/deaths during the year?

Investments

- ◘ Did you make any new investments during the year?
- ◘ Did you make any withdrawals from your investments during the year?

Cash and bank accounts

- ◘ Did you open any new bank accounts during the year that your accountant is not yet aware of?
- ◘ Have you properly recorded all petty cash income and expenses on a petty cash schedule?

Debtors and loans

- ◘ Does anyone owe you money? If so, you must keep a record of the interest charged on the account, together with any repayments received and further loans negotiated.

Liabilities

- ◘ Did you provide security for any new loans at financial institutions during the year?
- ◘ Did you enter into any new loans with related parties and/or financial institutions?

Creditors

- ◘ Are there any amounts due within the next 12 months that you still owe to other parties for items purchased?

Employees

- ◘ Have all returns been submitted to the Department of Labour (UI-19 and return of earnings or RoE) and SARS (EMP201), and are they up to date?
- ◘ Were there any new appointments/dismissals/resignations during the year?
- ◘ Did you keep a record of how much PAYE, UIF, and SDL was paid over for each employee?

Finalising the year's tax

The *Companies Act*, as amended, stipulates that the directors of a company or CC are required to finalise their financial statements within six months of the end of the financial year.

When compiling financial statements, a good accountant will always determine which tax allowances his/her client qualifies for and discusses this with the client so that the necessary preparations can be made.

By using the aforementioned list, he/she can determine whether your business qualifies for any deductions. Once the financial statements for the year are finalised, your tax practitioner can use the year's profit to make tax adjustments, after which your taxable income for the year will be determined. Applying the relevant tax scales to your business will allow you to determine the tax liability for the year, after which the provisional tax you have already paid will be deducted.

The difference between the final tax amount for the year and that which you have already paid must be settled by the end of September to avoid overdue payment interest. The aim is therefore to finalise your business's financial statements in March or April each year, leaving you enough time to apply the necessary cashflow planning to have the money ready in September.

Accounting essentials

To make things as easy as possible for your accountant, keep files with the following documents in them:

- VAT201 calculations and returns.
- UI-19 calculations and returns.
- EMP201 calculations and returns.
- Bank statements.
- Invoices for assets purchased.
- Contracts entered into during the year.
- Investment statements from financial institutions.
- Tax certificates – IT3 (b), (c) and (s).

Diesel rebate

Sectors that qualify for the rebate are agriculture, mining, forestry, coastal shipping, commercial fishing, offshore mining, and rail transport. The diesel rebate is claimed in terms of the *Customs and Excise Act*, and the claim is completed on the VAT201 return. In order to submit a claim, a person must first register by completing and submitting a registration form, the VAT101D form. Claims can be submitted for up to two years retrospectively for diesel consumption, unlike VAT inputs which can be claimed for five years. However, documentation must still be kept for five years.

The diesel rebate can be claimed for primary farming activities. Activities that are specifically excluded from claiming the rebate are where the nature of the product is changed and is no longer considered a farming activity, for example the processing of grapes into wine.

The refund is also only claimable if diesel is supplied on a dry and not a wet basis. This means the farmer must supply the diesel to a contractor if, for example, the contractor is harvesting or transporting something for the producer. If the contractor purchases the diesel himself and invoices the producer

for diesel and harvesting/transport costs, the producer cannot claim the rebate on the diesel purchased by the contractor.

It is especially important to understand that the rebate can be claimed on diesel consumed and not diesel purchased. It is therefore of the utmost importance that the producer keeps a register to determine how much diesel is consumed for primary business purposes during the period for which a claim is submitted.

SOURCES
- Van Eden, F. 2018. Prepare for the end of the financial year.
- Nel, G and Rheeder, H. 2014. Kyk die belasting-gaarder in die oë.

2.3 FINANCE

2.3.1 The farm budget

A budget is a form of future plan that must be prepared on the basis of certain assumptions, previous years' price levels, price increases, forecasts, as well as personal experience.

An **operating budget** is a budget of the expected expenses, income, and profit associated with a single branch. A separate budget must therefore be prepared for each branch. This type of budget can help a producer identify a few branches for his farm based on available resources.

Partial budgets are used to evaluate the effect of a slight change in the total farming budget, e.g. whether a dairy farm should produce its own maize or purchase it.

Break-even budgets help a producer to calculate at what point during production his total costs will equal his total income. This is determined in physical or monetary terms.

> A total farm budget is used to look into the changes being considered in a farming enterprise.

A total farm budget

A total farm budget is a summary of a producer's planned production figures per branch, as well as the resources required to achieve them. A total farm budget is used to look into the changes being considered in a farming enterprise.

Current and envisaged branches can be compared using a total farm budget. This way, the plan with the greatest impact on the farm's net farming income can be identified.

This budget can help the producer determine whether management requirements can be adjusted according to new branches and what the cost of switching to the intended branch will be. Budgets allow for the identification of more feasible plans. It outlines the impact of each plan on the farm's cashflow and helps to identify the risks associated with each plan.

The risk increases as the budget period progresses. When drawing up budgets, information should be used as accurately as possible to ensure the realistic calculation of results. One method that can be used to quantify the risk of price changes affecting net farm income and farming profits is to use good, bad, and general price calculations.

SOURCE
- Lombard, WA. 2014. The elements of a total farm budget.

2.3.2 Financial record-keeping and statements

The information presented in financial statements entails historical information that normally covers a 12-month period of the business's financial year. These financial statements reflect the assets, liabilities, and owners'/shareholders' equity on a specific date in a specific year, as well as the results of activities performed over a certain period – in other words, the income, expenses, and net profit or loss for the period. In short: You are your financial statements.

The information required for preparing the financial statements must be as accurate and complete as possible. This information usually consists of the following:

- Income for the period.
- Expenses for the period.
- Asset register.
- Register of loans and obligations.

Several important role-players must use the information available in the financial statements. As a producer/entrepreneur you must first be able to determine from the financial statements how effective the farming activities have been during the period in question. This information is used to plan for the following year, to improve farming practices, and to prepare your cashflow and budget for the following year.

Various financial ratios can be calculated using the information in the financial statements. These ratios involve determining trends by comparing income, expenses, and net profit or loss with that of previous periods.

These trends will provide actionable information that assists with more accurate predictions regarding future activities and the effectiveness of the business/farm.

Your financial statements

Financial statements are also used by statutory bodies to calculate income tax, capital gains tax, VAT, UIF contributions, and contributions to the Compensation Commissioner. If your financial statements do not contain complete information, it is possible for incorrect payments to be made. Underpayment runs the risk of having to make additional payments (penalties and interest), whereas overpayment will affect the cashflow of the farm.

Financiers depend on the information contained in the financial statements as they use this information to determine the farm/enterprise's repayment capacity and security value. They will also use it to determine the size, interest rate, and term of a loan.

Financial statements are also essential for retirement planning, succession funding, and exploiting business opportunities.

SOURCE

- Kirstein, J. 2013. Decipher your financial statements.

2.3.3 Financing

No modern farming operation can expand and thrive without external financing. There are, however, some pitfalls to be aware of as poor financing decisions can put the farming operation's survival at risk.

Choose the correct loan term

The length of a loan's repayment term and the lifetime of the asset being financed must be compatible. Producers usually make two mistakes: one is to finance a medium- to long-term asset with a short-term loan and the other is purchasing a medium-term asset with a long-term loan.

A longer-term project such as irrigation for pastures or fodder production will take

a considerable amount of time before it yields maximum returns. Initially the income stream will be slow and will gradually increase until the cultivated pasture is in full production. The loan must match this production rhythm.

The shorter the loan term, the higher the annual repayment. A project that is initially slow to generate an income and only comes into full production after a certain period of time will put the farm's cashflow under pressure. The shorter the repayment term, the greater the pressure.

Longer-term loans are usually secured through a mortgage over long-term assets such as land. This is a relatively time-consuming and expensive process. Producers then tend to take shortcuts by using short-term capital such as production loans and overdraft facilities to finance assets and projects.

Banks are also reluctant to extend the loan term of certain projects beyond a certain minimum period. Producers will usually accept the terms of the loan, eager to tackle the project. The solution to having accepted the wrong terms is then often to consolidate and refinance the loan/s over a period that will provide relief to the cashflow situation.

The opposite can also happen. In an attempt to make it more affordable, producers often finance equipment over too long a period. By the time the equipment then needs to be replaced, the loan has not yet been paid off. This is especially problematic when vehicles are financed with a balloon payment.

Over- and undercapitalisation

Overcapitalisation is when the assets acquired for a project are either more expensive than the project can afford, or more (in number or volume) than the project requires. For example, a producer has 200 ewes that lamb in lambing pens every month, but his lambing pens can house 400 ewes. Or a producer acquires haymaking equipment worth R250 000 for a 5ha lucerne field that can only be irrigated part-time. Or the producer purchases a four-wheel drive bakkie even though it is not necessary for the farming operations.

Overcapitalisation often occurs shortly before the end of the financial year, especially when the enterprise will have to pay taxes. One option then is to make expansions of a capital nature that are deductible from income tax.

Undercapitalisation is when a farm's production capacity is constrained by a shortage of equipment, infrastructure, and other inputs. As a result, the farm never realises its real profit potential. A classic example is a farm with unused and underutilised water and water rights, suitable irrigation land, and a favourable climate for fodder production.

Undercapitalisation is often the result of overcapitalisation and/or poor performance in another part of the farming enterprise, which leads to loan applications being rejected on merit.

Paying off debt with debt
A large debt burden puts a farm's profit under pressure, leaving little room for the producer to meet his own financial needs. This shortfall in owner compensation is then often supplemented by way of an overdraft facility. In this way, debt is unknowingly and indirectly financed with debt.

An overdraft that increases year after year is usually a telltale sign of such a situation.

Overoptimism
It is crucial that the economic viability of a project is evaluated against the most important risks. The three most important risks are usually drought, volatile product prices, and a change in interest rates.

It makes no sense evaluating the viability of a project against only average years' product prices and interest rates. It is always sensible to draw up different scenarios that will give you an idea of the viability of the project in drought years and in times of low product prices and/or high interest rates.

Poor business plans
Credit applications with really good financial merit are often rejected due to poorly prepared business plans. A well-constructed and credible business plan creates confidence with the credit provider.

Credit providers must ensure that the credit risk it takes when approving a loan is within acceptable limits. Credit providers profit from loans that are judiciously repaid. Therefore, they are firstly interested in the applicant's ability to repay the loan. They will then determine whether sufficient security is available, should the loan payments not be collected.

Untimely expansion
A stagnant farm is one that is actually deteriorating. Expansion is essential for any farm and there are two truths when it comes to expanding a livestock farm.

Banks regard the following aspects of a business plan as especially important:

- The **financial history** of the applicant, for example balance sheets, overdraft history, and previous loans.
- The **management profile** of the applicant, for example training, experience, integrity, and management skills. Banks want to know whether the applicant understands the application and will be able to execute it.
- **Repayment capacity** of which evidence includes credible multi-year budgets, so-called nightmare scenarios (worst-case scenarios) in which the three biggest risks are discounted in budgets, management plans and risk management measures, how project progress will be monitored, and a SWOT analysis.
- **Security.**

Firstly, do not expand before the farm is firing on all cylinders, and secondly, livestock farms are vulnerable to expansions that occur faster than the farm's cashflow can keep up with.

A farm should only be expanded when the existing business has been developed to its full capacity, productivity, and profitability. Overly large expansions to a livestock farm can be compared to an avalanche. At first, things happen slowly, but the situation eventually gathers more momentum until it develops into an all-out storm.

There is only one way to prevent this. Set short- and long-term goals and targets. Put them in writing and post them where everyone can see them, else they will remain just another wish list. Research has shown that people who write down

their goals are 42% more likely to achieve them than those who do not. Furthermore, people who share their goals with others are 78% more likely to succeed.

Desires over needs

In his book, *The Richest Man in Babylon*, George S Clason writes that people's needs increase in proportion to their income. In practical terms, this means people tend to confuse needs and desires. Make sure that when you spend money on a project, equipment, or anything else, it is driven by what is essential to success and not what will impress others.

SOURCE

- Du Pisani, L. 2021. Die sewe doodsondes van finansiering.

2.4 MAKING PROVISION

2.4.1 Succession planning

Approximately 80% of all registered businesses in South Africa are family businesses. Family businesses the world over are defined as businesses of which the family owns the majority of the shareholding, determines the strategic direction of the business, and intends to pass the business on to the next generation. Family businesses, especially family farms, have existed since the days of Cain and Abel, and remain the backbone of almost all economies today.

Succession planning to successfully pass the family business on to the next generation presents certain challenges. Global statistics show that only 30% of family businesses successfully transition from the first to the second generation, and just 14% make it from the second to the third generation. Most family businesses do not survive the third generation; there has been much speculation as to why so many family businesses close their doors after the third generation has taken over.

There are no statistics to prove this unequivocally, but family farms in South Africa generally survive longer than other types of family businesses. This is because most family businesses in South Africa that are older than three generations are indeed family farms.

Succession entails the transition of the family farm from the existing to the incoming generation. It also involves the transfer of management and ownership from the existing to the incoming generation.

Table 2.1: Aspects of a succession plan.

Aspect	Description
Vision	The enterprise's vision is a mental picture of how the family sees the future of the family farm over the long term. There must be consensus on this vision that the family will pursue.
Availability of successors	Determine whether there is a suitable successor or successors in the direct family. If not, determine the alternatives.
Preparation of successors	A plan must exist to prepare successors for their future responsibilities, for example, appropriate tertiary studies, exposure to the production and management aspects of family farming, etc.
Planning for all life events	Succession is not just about a future date on which the current generation wants to or will retire, but must also make provision for all possible events, such as: • What happens if the current owner becomes unfit for work or dies before the successor is ready to step in? • What happens if the successor is not available to step in, for example due to premature death or unwillingness to step in?
Business and financial structures	Business and financial planning should at least cover the following: • Is the existing business model suitable for transfer upon the death of the existing owner to the successor? For example, in the absence of a family trust which holds the assets of the family farm, the continuity of the farm can be severely limited if it is a sole proprietorship, as everything will be frozen until the estate is settled. • Estate planning aimed at minimising taxes and ensuring that the family business and next of kin can continue unhindered if something happens to the current owner. • Is the trust/s or will up to date and in line with the succession plan? Does it provide for family members who aren't successors but should benefit financially? • Has provision been made for any debts? • Has provision been made for retirement and are plans in place for when the current owner will or wants to retire?

SOURCE
- Diederichs, A. 2014. Opvolgbeplanning verg rentmeesterskap.

2.4.2 Retirement planning

When we do financial planning, especially when attending to the fair distribution of assets upon death, retirement funds can complicate the situation. Retirement funds are indeed your money, but they are regulated by legislation and by the rules of the particular fund. Pre-retirement funds include pension, provident, and preservation funds as well as retirement annuities. Retirement funds are managed by a board of trustees.

Let us look at aspects of the *Pension Funds Act, 1956 (Act 24 of 1956)* (the *Act*) that could complicate your plans.

Protection of dependants

As is often the case, pension money makes up the bulk of one's assets and you would want these assets to be distributed according to your wishes. This brings us to the first hurdle.

The intention of Section 37C of the *Act* is always to protect the needs of persons

who were dependent on the pension fund member at the time of his/her death. The board of trustees of the fund must perform their duties in terms of Section 37C, which include identifying and locating dependants (investigation stage), allocating the death benefit (decision-making stage), and determining the method of payment (decision-making stage).

Under 'normal' circumstances where there is still a first spouse and minor children, and the wish is that the spouse should benefit in order to care for him- or herself and the minor children, this is consistent with the intention of Section 37C and it is possible for the wish to be fulfilled. However, things can become more complicated in the case of a divorce where alimony is involved, minor children are named as beneficiaries, and there is a new spouse in the picture.

Children and ex-spouses

While children are still dependent, there is no problem and their portion is paid to their guardian who must manage the money on their behalf, or it can be paid into the child's own bank account. The money is protected in an account separate from that of their guardian and other beneficiaries and is managed by the guardian. Once the children are no longer minors and have become independent, there is a chance of them not receiving a payout.

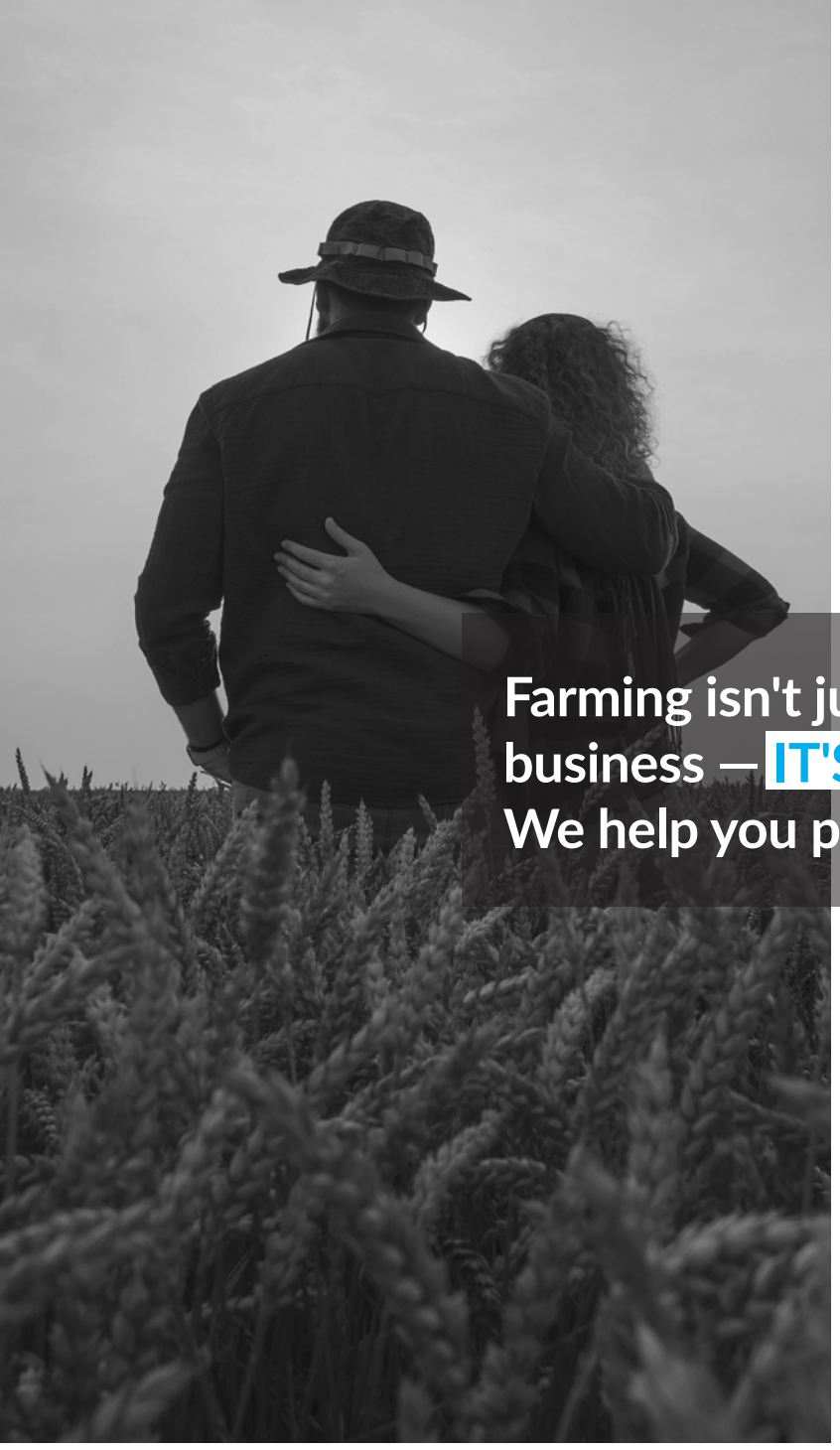
If maintenance is still being paid to an ex-spouse, this spouse is regarded as a dependent who can be added as a beneficiary, even if it was not your choice. A person who becomes involved in your life (sometimes after a divorce or even death) and becomes dependent on you in some way, can also qualify as a beneficiary. If this person is listed on your medical aid, short-term insurance and perhaps receives monthly funds paid over by you, it will be difficult to prove the contrary.

In a second marriage where both parties have children from a first marriage, you may wish to bequeath your pension or a portion of it to your adult child or children (who are not dependent on you). This action may prevent your 'new' spouse from later naming his/her child or children as beneficiaries of the pension received after your death. However, Section 37C may prevent your wish from being conducted. Good planning regarding the distribution of your assets is therefore essential.

Duties of trustees

A nominee can be any natural person, legal entity or trust who informs the board of trustees of the member's wishes. However, trustees are not bound by the nomination of beneficiaries, and the nominees are not automatically entitled to a claim. The list of beneficiaries remains in force until the situation changes. Only when the board of trustees has allocated the benefit to dependants and nominees do they become beneficiaries, and the benefit is due and payable.

The *Act* allows trustees 12 months to complete the investigation stage. During the decision-making stage, the trustees must use their discretion as to how the death benefit should be allocated. Dependants are always given preference.



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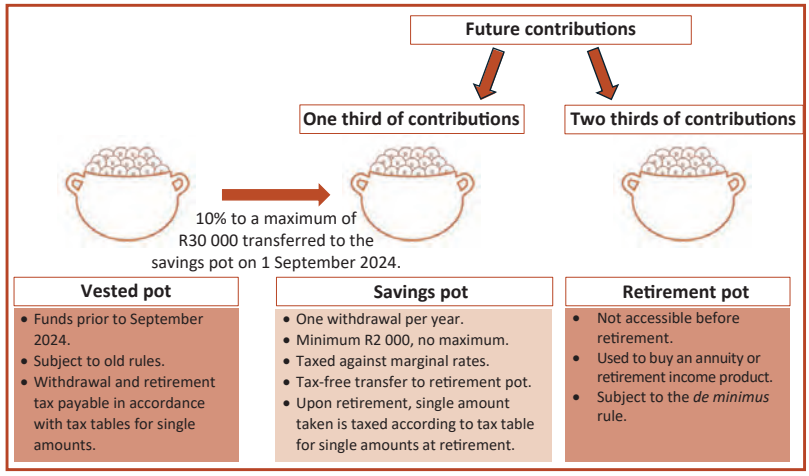
If there are only nominees or no dependants and nominees, the trustees do not have discretion as to the allocation of the benefit. If there are only nominees, the nomination form must be adhered to. If there are no dependants or nominees, the death benefit will be paid to the estate. An insolvent estate is paid before nominees can receive a benefit.

Figure 2.1: How the two-pot system works.



The two-pot system

Figure 2.1 illustrates the new two-pot system that became law in 2024. The new legislation includes contributions made to retirement annuities, pension funds or provident funds after 1 September 2024. Existing funds up until 31 August 2024 remain in the vested pot and are subject to the old rules and regulations. Only 10% (up to a maximum of R30 000) was transferred to the savings pot on 1 September 2024.

Who can participate?

If you were a member of a provident fund on 1 March 2021 and made contributions to that fund, were over the age of 55 on that date and still a member on 1 September 2024, you can choose whether you want to be part of the two-pot system. If the choice is not exercised, everything remains as it is, with the same rules.

However, if you choose to be part of the two-pot system, your retirement money will be divided into three components. The vested pot consists of your provident fund's fund value on 31 August 2024 plus growth thereon, minus the mandatory 10% or R30 000 of the fund value that goes to the savings pot. The savings pot then consists of the 10% or R30 000 that was transferred on 1 September 2024, one third of all contributions to the fund from 1 September 2024 and the growth thereon, minus any annual withdrawals.

The retirement pot will consist of two-thirds of all contributions from 1 September 2024 and all growth thereon. The tax on lump sums and annuity income from the vested pot and retirement pot respectively, remains unchanged as before in respect of retirement or resignation. Withdrawals from the new pot before retirement are taxed according to the income tax tables. Withdrawals from the pot at retirement are taxed according to the retirement tax tables for withdrawals.

SOURCES
- Rautenbach, E. 2023. Effektiewe bestuur van aftreegeld vir my nalatenskap.
- Rautenbach, E. 2024. Die nuwe tweepotstelsel vir pensioenfondse.

2.4.3 Estate planning

Regularly reviewing and drafting your will along with estate planning are some of the aspects that receive the least attention during our lives. No legislation stipulates that a will must be drawn up, therefore we do not always pay attention to it.

However, in various instances a will must be drawn up or adjusted/amended, namely:

- When you acquire substantial assets or assets accrue to you, regardless of your age.
- When you get married.
- With the birth of a child/children.
- Annual tax changes/adjustments.
- Expansion/change in farming activities.
- Death of a spouse.
- Death of a child.

Besides drawing up the estate, the appointment of its executor and/or administrator is particularly important. Legislation allows only certain persons/institutions to function as administrators.

Should you die without a will, you have died 'intestate' and then legislation will come into force to determine how the inheritance to the surviving spouse and children should be allocated. This usually leads to disputes among heirs. Dying 'testate' is associated with regulations on how the inheritance should be divided and managed.

Adequate provision

It is essential that, upon the death of the breadwinner or spouse, adequate provision be made for the surviving spouse(s) so that he/she is adequately cared for in terms of accommodation, medical and monthly living expenses. This is especially important if there is a child or children who have to take over the farming activities, whether jointly or separately.

The farming activities must be able to continue in such a way that it does not affect the spouse's income. It is therefore important to understand the influence of usufruct and other inheritance methods before it is entered in the will.

The executor

Upon a person's death, the estate must be reported to the Master of the High Court so that a letter of executorship can be issued. The executor can administer the estate him- or herself or else an administrator is appointed. The executor is the person who makes decisions, and the administrator ensures that the estate accounts are prepared according to the provisions of the will.

Upon receipt of the letter of executorship, the administrator can proceed with administering the estate. The executor/administrator appoints an assessor to appraise all assets as at the date of death.

A farm worth R10 million with R2 million worth of livestock on it is not a very large unit, but upon death there is still a substantial amount of tax that must be paid to SARS. The combined impact of estate duties, value added tax (VAT), and capital gains tax can have far-reaching consequences in the absence of proper estate planning.

It is advisable to consult an expert when drafting and amending a will. It is also important that your child or children who are to take over the farming activities are well aware of what the situation will be once a parent dies, and to ensure that there is sufficient cash available so that the farming enterprise, which has been built up over a long period of time, can continue operating without interruption.

Duration of estate administration

The process described here applies to estates with a gross asset value of more

than R250 000. Estates with an asset value of less than R250 000 are administered in accordance with Section 18(a) of the *Administration of Estates Act, 1965 (Act 66 of 1965)* and do not have to follow the formal process as stipulated in said *Act*.

How the process works

The estate administration process basically entails:

- An estate is reported to the Master's Office within 14 days of the person's death. The office is the one within whose jurisdiction the deceased lived during their lifetime (12 months before death).
- The various financial institutions involved – banks and insurance companies, SARS, creditors, and the like – are notified of the deceased's death and all details relating to his/her investments and other assets are obtained. Appraisals are requested of movable and immovable assets.
- An executor's letter is issued.
- In terms of Section 29(1), a debtors' and creditors' advertisement is placed in a local newspaper and *Government Gazette* for a period of 30 days. (Keep in mind that the notice in the *Government Gazette* must be at the government printer approximately 14 days before the advertisement is to appear.)
- SARS returns are submitted and completed.
- Investments and insurance are queried, and the liquidation and distribution account (L&D) is drawn up.
- A copy of the L&D is lodged with the Master's Office, and a copy is placed at the magistrate's office for inspection.
- At the same time, another advertisement (in terms of Section 35) is placed for a period of 21 days to inform the public that the L&D has been lodged with the Master's Office and is available for inspection at the magistrate's office.
- If no objection has been received in respect of the account, the executor may transfer the estate assets and pay creditors and heirs. (The *Estates Act* stipulates that an executor has three months to settle the estate if no objection was lodged against the account.)

If the process is followed without any hurdles along the way, an estate can be settled within six to nine months. However, there are 'new' challenges these days that can extend this process indefinitely.

SOURCES

- Kirstein, J. 2013. Boedelbeplanning en jou testament: Die beginsels.
- Smith, R. 2025. Hoekom neem dit so lank om 'n boedel te beredder?

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3 ON THE FARM

3.1 PRODUCTION SYSTEMS

3.1.1 Intensive sheep farming

History teaches us that extensive sheep production has been practised in South Africa since the seventeenth century – and that it was the only production method practised for about 350 years.

An intensive production system can be broadly defined as one where large numbers of animals are housed on a relatively small piece of land. When considering typical intensive production systems such as poultry, pigs, and even some dairy producers, it is easy to see a connection with this definition.

In the case of sheep, intensive production involves the following:

- Many sheep are housed on a small piece of land thanks to the provision of supplements and even complete feed rations.
- The optimal nutrition ewes receive makes it possible to accelerate lambing intervals (most ewes lamb every eight months, or three times in two years).
- Due to the higher feed and management costs, more lambs per ewe are required to make a profit. The rule of thumb is that each ewe should produce five lambs in a two-year cycle.
- Ewes are synchronised and mated in small groups, or artificial or laparoscopic insemination practices are applied. This means all the ewes in a group will lamb within a few days of each other and the entire group can be kept and cared for in lambing pens.

In addition to higher productivity on a smaller piece of land, intensive sheep farming also offers a solution to other challenges faced by the producer, such as losses due to predators and theft. The effects of drought can also be reduced, as the animals do not rely on natural grazing and are provided with feed.

A more intensive management system does require more intense management and daily inspections which, among others, involves following a proper animal health programme, especially since pests and diseases can spread like wildfire in an intensive system.

It also involves a higher cost factor. It is more expensive to feed sheep than it is to let them graze on natural pastures, and more money is spent on animal health care and aspects such as housing and lambing pens.

Dos and don'ts

Intensive sheep farming involves manipulating the production environment of the ewe flock so that ewes can reproduce optimally. Better nutrition is emphasised, along with accelerated, more intensive lambing systems.

Producers often rush into getting intensive sheep systems off the ground without them having the necessary management skills. Usually, this is done with a flock of ewes that are unable to respond to the improved environment. The producer then expects results in the absence of basic aspects relating to good flock and feed management.

The starting point of successful intensive sheep farming is precision farming and maximum profit – not maximum reproduction and turnover. Sheep producers should only intensify when they are farming the right flock, possess the necessary management skills and infrastructure, and are already doing the basic management tasks well. Until then, the emphasis should be on precision farming.

The laws of precision farming

Precision farming involves a good understanding of those production factors and inputs that lead to optimal production and profit, managing them, measuring, evaluating them, and making timely adjustments where necessary. It is therefore essentially a systems approach, where all the factors that determine the success of the system are reconciled, and of which intensification can naturally form a part.

The first law of precision sheep production is sustainably managed veld that is in good condition, and a stocking rate that is in harmony with the farm's carrying capacity. The second law demands a breeding flock that easily and regularly becomes pregnant under their particular environmental conditions, successfully completes their gestation periods, produces viable and healthy lambs without problems, and successfully raises and weans their lambs.

The third law is the pursuit of maximum profit.

Veld and flock management

Every sheep flock has breeding animals that regularly become pregnant, complete their gestation, lamb without problems, and raise their lambs well. At the same time, every flock has breeding ewes that produce little to no offspring. The secret to building a reproductively efficient breeding flock is identifying the poor performers as early as possible and removing them from the flock.

Research from around the world indicates a strong relationship between the reproductive performance of breeding ewes during their first reproductive cycle, and their reproductive performance over the rest of their lifetime. Replacement ewes that reproduce well during their first

lambing season, do so across the rest of their lifetime, and vice versa.

In the 1990s, 15 wool producers took part in a ewe project on the farm Groenvlei in the Graaff-Reinet district. Each participant took ten weaning-age ewes to Groenvlei, where these 150 ewes were kept as one flock for the rest of their productive lives, and given the same management. Read more about this project in the December 2021 issue of *Veeplaas*.

The ewes were artificially inseminated with the semen of one ram each year during autumn, after which they were kept with backup rams for 34 days. Each ewe had five lambing opportunities over her lifetime. They lambed on veld in September each year and their lambs were weaned in February. It was possible to identify the top ewes during their first lambing opportunity (*Table 3.1*). Those that skipped in the first year skipped at least once thereafter.

Tabel 3.1: Connection between reproduction of Merino ewes in year one, and the rest of their lifetime. (Statistics from the Groenvlei ewe project)

Number of lambs weaned at first lambing opportunity	Number of lambs weaned over ewes' lifetime
0	4 (80%)
1	5 (100%)
2	7 (140%)

Profitable reproduction

Livestock producers are generally under the impression that maximum profit is generated when their herd reproduces maximally. While marginality (or diminishing returns) is a familiar concept to most producers, they often still get caught in the subsequent trap.

Maximum yield does not necessarily lead to maximum profit. In fact, in livestock farming, maximum profit is usually realised at yields that are below maximum.

Producers are often advised to produce more per animal, when the recommendation should rather be to produce more economically and more per hectare.

As soon as the cost of increasing production exceeds the associated income, the producer enters a danger zone. This can happen when they blindly attempt to raise the herd's reproduction rates as high as possible.

The greater the difference between an input cost (for example, creep feed) and the yield of that cost (for example, income from meat), the closer the maximum profit will be to the maximum yield. The reverse also applies and is known as the law of diminishing marginal returns. The smaller the difference between input costs and output, the smaller the chances of realising a profit.

This relative relationship between product prices and input costs is constantly changing. A practice that delivers maximum profit this year will not necessarily yield maximum profit again next year. For example, if the price of creep feed were to increase faster from year one to year two than the price of A-grade lamb, the level at which creep feed promotes profit will necessarily be lower in year two than the level in year one.

Practical guidelines

The practical importance of the principle of marginality for livestock producers includes the following:

- Aim for maximum profit per hectare, and not maximum yield per animal.
- Inputs must be utilised economically. A good example is the strategic use of feed. A lamb's feed conversion capacity decreases as it ages. The sooner creep feed is given, the better the profitability. Creep feed should also be suspended early, before it reaches the point where the lamb no longer grows profitably.
- Be careful not to build up a herd that is dependent on price-sensitive inputs, because the farm's profit can come under pressure in years when those inputs become very expensive.
- Refine the management of input costs. Negotiate the best prices and compare product prices based on the content of each. For example, do not compare licks kilogram for kilogram, but rather the kilogram of protein in each lick.
- Certain production practices yield better marginal returns than others, for example, creep feed for lambs younger than 30 days versus lambs older than 60 days. Similarly, there are times in the reproductive year of a breeding animal when some inputs yield better marginal returns than at other times. For example, it is better to get ewes in good condition during the last third of pregnancy, than to neglect them during pregnancy and then try to assist them after they have lambed – the damage has already been done, and no feed programme will reverse it.
- Produce top-quality products for which a good market exists and for which top prices are paid. Improve your marketing management and don't accept the first best price. Enter the marketing chain where possible and exploit vertical integration opportunities.
- Analyse the economic and biological performance of the farm annually and identify those aspects that are hindering profit.
- Do not follow a one-size-fits-all approach to profit. What works this year may not be affordable next year.
- Marginality requires the modern livestock producer to apply precision farming techniques. It is therefore imperative to determine where to realise the best yield for every R1 of input cost.

SOURCES

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3.1.2 Weaner calf or ox system

Weaner producers are under constant pressure and when the going gets tough, there are alternative production systems that could prove to be more profitable. However, warns Prof Frikkie Neser of the University of the Free State, fertility in a beef herd is more important than growth, which is why cows that do not raise a calf every year should be summarily culled. Fixed breeding periods are essential for optimal utilisation of natural resources.

South African commercial beef producers maintain a weaning percentage that ranges from 60 to 80%. This means 20 to 40% of their cows do not calve every year. By removing those cows from the herd and raising oxen in their place, the available pasture will be optimally utilised, and more meat will be produced per hectare, putting more money in the producer's pocket.

Producers can go even further by keeping smaller-framed cows on which large-framed bulls are used. This system creates space for more cows, or the same number of cows with room for more oxen. The advantage of such a system is that crossbreeding, which potentially delivers 25% better performance due to hybrid vigour, is also utilised.

There is a saying that oxen boast a 100% calving percentage. This means oxen gain the same or more weight per year than a weaner calf's growth. At the same time, the risk is lower because with the same management, there will be fewer steer mortalities than weaner deaths.

Important factors

When deciding which production system to use, important factors to consider include the profitability of the system, the available fodder flow, the system's production efficiency, what other branches are operated on the farm, the size of the farm, personal preferences, market requirements, distance from markets, climate and carrying capacity, and the breed and frame size of the animals.

Operating a successful cattle farm essentially requires animals to be marketed from the veld with as little supplementary feed as possible. Early maturing cows with a medium to small frame are best suited to such a system. This includes all indigenous and most synthetic breeds.

There is a major difference between different breeds' ability to grow on veld. Even within breeds the difference is big. It is therefore important to select for animals that are able to grow on veld. Figures from the Vrede Veld Bull Club, which used three breeds of cattle, showed that the difference in growth between the best and worst animal within each breed (expressed in monetary value) was R975, R1 125, and R1 350 per animal, respectively.

Fertility

Fertility, however, remains more important than growth and in this regard, management plays a major role. A commercial producer with 25 cows can expect an income of R45 900 per year with a calving percentage of 65%, while a stud breeder exercising better management and marketing, producing high quality meat, and yielding a calving percentage of 85% can expect to make R72 160 per year (*Table 3.2*).

Table 3.2: Comparison of commercial and stud producers' income per year. (Source: Agricultural Research Council)

	Commercial	Stud
Calving percentage (25 cows)	65%	85%
Pre-wean mortalities	4%	2%
Post-wean mortalities	2%	2%
Calves weaned per year	16	21
Calves to sell	15	20
Average weight	180kg	205kg
Price/kg	R17	R17,60
Potential income per year	R45 900	R72 160
Potential income per month	R3 825	R6 013

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Some of the advantages of a weaner system are that weaner prices are cyclical in nature and a producer employing good management practices can take advantage of high prices. In addition, his/her selection potential is greater as there are more cows to choose from and there are no risks when the weaner calves have left the farm.

In terms of disadvantages, most producers wean their calves at the same time and a large supply then tends to force prices down. Replacement heifers must be selected at a very young age and during drought the producer may be forced to sell some breeding cows. Recovering from drought takes a long time and marketing options are limited.

Marketing options

An ox production system has the advantage that herd numbers can be easily controlled in times of drought while maintaining the breeding herd in the same way. More marketing options are available, management is easier, the oxen grow as much or more than weaners in a year, and the producer can optimally utilise natural growing periods. Drought can be managed more easily and there is no further weaning shock to contend with while the oxen are growing out.

The disadvantages of such a system are that oxen aged 18 and 22 months are difficult to market, they often have to be finished for marketing, there can be post-weaning losses, as well as cashflow issues.

A producer who switches from a weaner to an ox production system will, for the first year, only earn income from the cows he can reduce and sell until he can start selling oxen and heifers in the second year. This can create a cashflow problem, which can be alleviated by selling a portion of the calf crop during their transition as backgrounding calves.

Producers can use their own calving percentages and mortality rates to determine what the difference in yield on their farms under their unique conditions would be. The lower the weaning percentage and the higher the carcass price, the greater the advantage of an ox production system.

3.1.3 The farm feedlot

Establishing a feedlot on your farm can add value to your weaner calves. However, it requires meticulous management and informed decision-making to ensure that it develops into a profitable branch of your beef cattle farming enterprise.

Several external factors related to the agricultural industry also play a role. Take load shedding, rising fuel prices and disease management for instance – all of which had and continues to have a major impact on the industry, with feedlots owners expected to simply make the best of it.

Nutrition, marketing, and the feedlot conditions in which the livestock must thrive are other key factors that require daily monitoring. In addition, feedlots entail a long-term game, so planning ahead and making provision for adequate finances and strategic management are essential.

Feedlots operate at low margins and are volume driven. Deciding the right volumes for the feedlot can therefore either make or break your business. When drawing up your business plan, you must know what the total minimum 'break-even point' in terms of volume is to justify the capital outlay. This will give a good indication of what size the feedlot ought to be.

3.1.4 Business model components

Concept: The business model concept consists of detailed information pertaining to the business, including the goals you want to achieve, the nature of the business, existing products, and why you want to establish the business or a new project to expand your existing enterprise.

Short- and long-term goals: Both must be recorded and achieved.

Ownership and management: The business model must include the type of ownership of the business as well as a summary of the shareholders, directors and management. How will inheritance and management succession be handled?

Setup costs: Capital expenditure in terms of equipment and machinery, as well as who will do what, must be included in the details of the business model.

Environmental impact: Address factors such as climate impact, soil type and water requirements, water runoff and the like. Producers also need to complete their due diligence and check whether municipal approval is required, the details of which must also be included in the model.

Production plan: Key factors to include in the production plan are the production process, stock management, purchases, sales, complete crop budget, along with detailed breakdowns of expenses and feed quality.

Marketing plan: Ask yourself the following questions: What is unique about my process? How do I differentiate myself from the competition? What do my monthly sales targets entail? How many animals am I going to buy, and where and from whom am I going to buy them? Also consider market trends in terms of selling prices.

Biosecurity: Ask yourself if you have the necessary measures in place to protect your animals from disease. What processes will you follow when buying in livestock? Do you have quarantine facilities and how will you manage them? Are the quarantine camps isolated? What checks and proof will you require as to the health status of the animals you plan to purchase?

Financial plan: Focus on margins, break-even analyses, stress tests of your assumptions, as well as key mathematical ratios such as your cashflow margin and especially your anticipated feed conversion ratio (FCR). The biggest expense is the feed and calves you buy, and to mitigate this expense you need a good FCR. Here you must look at things such as what the ration with the highest level of energy will cost you; animal health; the genetics of the animals you buy so as to allow for quick finishing in the feedlot; the purchase price of weaned calves as well as the selling price of the finished animals; and animal performance.

The business plan must include a detailed cashflow budget for at least five years, including your total anticipated debt and how you will finance the business' working capital.

General principles

- Start slowly and ensure that your cashflow will be able to take the first group of animals through the entire cycle. Having to stop halfway through to sell half-fed animals translates into a big loss.
- Summer is the ideal time to start a feedlot on the farm, especially for grain producers who also keep cattle. Feeding your maize to your own cattle is sometimes a better option than marketing it.
- The perfect time for a feedlot to add value to weaners/grain is when the weaner price is low, maize is cheap, and the meat price is high.
- Other success factors include being located close to meat outlets, ensuring that weaners are available all year round, and ensuring access to slaughter facilities. The most beneficial scenario is having the animals slaughtered directly at an abattoir, rather than offering them for sale at fatstock auctions.
- Fix your slaughter dates at the abattoir well in advance, so that your animals are not slaughtered during the quiet times while established clients enjoy the benefit of slaughter during periods when the meat price is higher.
- The finishing process can be part of a strip-pressure grazing system with movable water and feed troughs. It can also be done where forage crops are grown under pivot irrigation.
- If a producer also cultivates grain, a farm feedlot will afford him/her the opportunity to use high yield potential land for grain cultivation only, while the rest can be established as cultivated pastures. These pastures can be cut, baled and sold or kept for own use, or it can be utilised as standing hay.

Principles for feedlot facilities

- Good planning is essential and also has to take your neighbours into account. Both parties must be assured that runoff from the feedlot will not pollute streams or dams. Smaller and bigger feedlots are subject to different regulations, and the producer must make sure which of these requirements are applicable to his environment.
- Erect the feedlot on a site known for its poor grazing potential and which is located far from neighbours and open water. Feedlot animals require standing room of about $15m^2$ and feeding space of 330mm each.
- The kraal can take on various forms. A well-designed, permanent steel construction or a few wire-fenced camps on natural grazing will initially serve the same purpose.
- The size of the pens or the use of mobile camps will be determined by the producer's own objectives. These systems make it easier to feedlot animals at certain times of the year.
- Feedlot cattle are handled only three times during the finishing cycle, but equipment such as neck clamps, body clamps, a scale, and some form of kraal are necessary.
- To handle the animals properly, the crush needs to run slightly uphill and around a bend; this is because the animals will exit more easily against a slope. The crush must contain a neck and a body clamp.

SOURCES

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- Du Pisanie, K. 2024. Business model for a farm feedlot.

3.2 BIOSECURITY

3.2.1 Biosecurity on the livestock farm

Biosecurity is defined as preventing, minimising, and ultimately prohibiting the spread of infectious and highly transmissible animal diseases, which can be detrimental to the livestock industry, on and between farms.

There are various role-players in the biosecurity arena, including the state, organised agriculture and individual producers. Livestock producers must realise that poor biosecurity can ultimately jeopardise their survival. Each livestock producer must implement the necessary control measures and ensure that biosecurity starts at his or her own farmgate.

Substandard biosecurity

In the case of individual producers, substandard biosecurity can erode a farming enterprise's profitability due to, for example, the total or partial culling of herds or flocks, higher animal health costs, the cost of replacement animals to be slaughtered, increased mortality, reduced production and reproduction, poor growth, and the rejection of products such as wool and meat.

The value chain of livestock industries can also suffer serious damage. Take, for example, the knock the wool industry has taken the past few years. Auctions were postponed for long periods due to an export ban, wool piled up in brokers' stores, buyers could not deliver their orders to the international markets, and wool shipments came to a standstill and were later disrupted after auctions resumed.

Export markets may lose confidence in South Africa's ability to supply healthy products. In the long run, this could have a serious negative impact on our export possibilities.

Of course, zoonotic diseases can also infect humans, with serious consequences such as infertility, abortions and blindness. Treating zoonoses is often difficult and not always successful.

Controlled, notifiable diseases

Whenever biosecurity is mentioned, most people are of the opinion that this mostly refers to foot-and-mouth disease (FMD). Biosecurity, however, encompasses a whole range of diseases. The *Animal Diseases Act, 1984 (Act 35 of 1984)* refers to controlled and notifiable diseases, both of which must be reported to a state veterinarian according to legislation. Refer to Chapter 6 for more information in this regard.

The diseases of economic importance that livestock producers should pay attention to are FMD, brucellosis, anthrax, sheep scab, Johne's disease, bluetongue, Rift Valley fever, lumpy skin disease, malignant catarrhal fever, trichomoniasis, pizzle rot, bovine viral diarrhoea (BVD), vibriosis, botulism, clostridial diseases, African and Asiatic redwater, heartwater, gallsickness, three-day stiffsickness, enzootic abortion and blackleg.

Despite the fact that excellent vaccines and other preventive measures are available for most of these diseases, they continue to spread like wildfire in cattle herds and sheep flocks due to a lack of effective biosecurity measures.

Biosecurity in practice

Effective biosecurity involves several components, including isolation, traffic control and sanitation aimed at reducing exposure to bacteria, viruses and other organisms that can infect animals.

Producers must introduce an appropriate level of biosecurity on their farms and between farms. Having an excellent biosecurity programme in place helps to reduce the risk of pathogens being transferred on or between farms.

All animals in the herd or flock should be monitored regularly for signs of disease. Pay particular attention to:

- Sudden, unexplained herd or flock mortality.
- Serious disease outbreaks affecting a high percentage of animals.
- Blisters around an animal's mouth, nose, teats or hooves.
- Unusual ticks or maggots.
- Animals that wander aimlessly, stumble, fall or exhibit central nervous system disturbances.
- Abortions or stillbirths.

Controlled access to the farm

Controlled access to the farm and livestock herds or flocks is essential. The property's gates must remain locked at all times and all visitors must sign in upon arrival and sign out upon departure. Display signs that are clear, straightforward and highly visible to declare that biosecurity on the farm is non-negotiable. This can include a sign instructing people to report to the house or office before entering the rest of the property.

Allow only essential vehicles and visitors access to the farm and keep these vehicles in a separate area. Vehicles entering and leaving your property must be kept away from areas with animals, or their tyres must be washed with disinfectant.

Keep foreign visitors off the farm for at least five days after their arrival in the country. Ask foreign visitors to provide information on recent farm and animal contact. Shoes, as well as any items and equipment such as cameras, must be disinfected. Discourage foreign visitors from walking through feeding areas and having physical contact with animals. Where possible, provide disposable protective clothing. Provide visitors with a footbath containing disinfectant and a brush to scrub their shoes.

Most of these rules also apply to any outside visitors coming to work with your animals, for example livestock specialists, veterinarians, people who perform pregnancy scans, as well as wool classers and shearers. Make sure they don't unknowingly bring disease on to the farm – disinfect their clothes, shoes and equipment by providing disinfectants, shoe brushes and washing facilities.

Purchasing new animals

When purchasing new animals, make sure the health status and origin of these animals are known. Only use a trusted source when buying animals. It is worthwhile having a veterinarian examine animals before buying them. Vaccinate and dose newly purchased livestock before they are transported to the farm, so as to keep another farm's resistant parasites away from your own farm.

Isolate new animals or animals returning from another farm – cattle, goats, sheep, horses, and poultry must be quarantined for 30 days and pigs for 60 days. The quarantine area must be located some distance from other animals, and vehicles such as feed and livestock trucks must be prevented from driving through the quarantine area.

Equipment used in the quarantine area must be kept separate from other equipment and thoroughly disinfected

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before and after use. The quarantine area's feed and water buckets or troughs must also be kept separate and thoroughly disinfected once the quarantine period has lapsed. Separate the garbage and other waste from the quarantine area and burn it where possible.

People working in the quarantine area must put on clean clothes before coming into contact with the rest of the farm's animals. After having handled quarantined livestock, these workers must wash their hands thoroughly and disinfect their shoes.

When it is necessary for people to be in close proximity to animals from another farm, consider issuing protective clothing such as overalls and boots, which can be cleaned and disinfected before entering the property and upon leaving.

Transporting animals

When it comes to moving livestock from your property, make sure they are fit to travel before loading them. Sick and injured animals must not be moved. Call in the help of a veterinarian if necessary.

When animals are bound for shows, a veterinarian must declare them disease-free beforehand. Kraals and housing areas at shows must be cleaned before the animals are kept in them. Feed and water your own livestock if possible. Never share equipment with others – if you must, always disinfect it before and after use.

Upon returning to the farm, be sure to isolate show animals for at least ten days. If you are transporting your own animals, the truck must be washed, boots cleaned and disinfected, and overalls changed before returning to your farm.

Additional steps

The following additional measures ought to be applied:

- Keep all fences in good condition to keep out strange animals.
- Control the movement of pets and poultry.
- Control pests such as rodents to prevent the spread of any disease these animals might carry.
- Buy feed only from reliable sources.
- Report confirmed or suspected cases of controlled and notifiable animal diseases to your nearest state veterinarian.

SOURCE

- Du Pisani, L. 2022. Biosecurity for a profitable, sustainable livestock farming enterprise.

3.2.2 Biosecurity at feedlots

The first aspect is fence and gate maintenance. Sturdy, well-maintained fences and gates will keep unwanted animals out of the lot and limit contact between feedlot animals and wildlife or other livestock from the vicinity.

Infections can be transmitted by animals, people and vehicles. Feedlot access must therefore be controlled, and workers and visitors need to wear high-quality protective overwear. Use a suitable disinfectant for disinfecting trucks and the vehicles of visitors and staff. A footbath for visitors and workers is also recommended.

Animals should be processed within the first 24 to 48 hours of their arrival at the feedlot. This usually involves vaccinations,

treating them against internal and external parasites, and marking the animals. If necessary, preventive treatment against tick-borne diseases must also be provided.

Part and parcel of strict biosecurity measures is the thorough, hygienic processing of livestock. Needle hygiene, human hygiene and correct application methods are all key aspects of successful processing. Another important factor is making sure that the active ingredients the agents contain, are still effective against the ecto- and endoparasites for which they were developed. Always administer the correct doses, as underdosing is not only ineffective, but also contributes to the development of drug-resistant parasites and bacteria. Seeing as infectious diseases can become a huge problem in feedlots, vaccination is an essential component of preventive treatment and biosecurity.

Young animals that arrive at a feedlot must go to larger isolation camps for around 21 days. This leaves enough time to diagnose and treat animals that were asymptomatic upon arrival and to keep diseases from infecting the rest of the herd. The period spent in the isolation camps also affords animals enough time to systematically adapt to the high-concentrate feedlot ration.

A crucial aspect of biosecurity that is often neglected is obtaining complete records of newly purchased animals. This includes information regarding the farm of origin, individual animals' vaccination and disease history, and the agents used for treating and managing diseases in the herd. The success of a feedlot mainly depends on how good the biosecurity protocol and animal health management systems are.

SOURCE

- Du Pisanie, K. 2024. Biosecurity for feedlot success.

3.2.3 Biosecurity in intensive lambing systems

Strict biosecurity measures are essential in all farming systems, but even more so in intensive farming systems such as intensive lambing systems. Although intensive lambing systems are closed systems in which access, hygiene, and many other aspects are easier to control, there are several biosecurity pitfalls that require extra attention.

Animals in an intensive system more frequently come into contact with specific areas and with each other. This increases the chances of one animal infecting another with a disease, after which it can quickly spread throughout the entire group. Animals in an intensive system usually experience higher stress levels than those farmed in extensive systems. Immunity tends to decrease when stress levels increase, making animals more susceptible to diseases and parasites.

General guidelines

Bedding: Problems can arise if bedding is insufficient, and when ewes and lambs are constantly exposed to their own manure and urine. Too little bedding will cause manure and urine to easily flow from one pen to the next. Manure and urine can be carriers of various harmful organisms.

Excessive use of pens: In an intensive lambing system, it is very important for pens to be thoroughly cleaned, but also rested, between each round of lambs. On a very busy farm it is easy to fall into the trap of repeatedly using the most conveniently positioned pens. It is important to guard against this habit. Manage the pens in such a way that diseases are not allowed to build up in them.

Isolation of sick lambs: In intensive lambing systems, one often sees sick lambs being treated against a disease but not separated from the rest of the group. This causes disease to easily spread to animals in other pens.

Human spread: When it comes to the spreading of a disease on a farm, the producer, his/her workers, the veterinarian, and any other people who come into contact with the animals and then move around, are often the main culprits. For example, when you work with one lamb and then move directly to the next pen, the disease or parasite moves with you.

Carrier animals: It often happens that pregnant ewes without records are bought in to lamb in an intensive lambing system, without having been quarantined. This allows for a disease to very easily establish itself in your 'maternity ward'.

Orphaned lambs: Orphaned or rejected lambs are often fed without the bottles being properly washed after use. Every so often the same bottles are used for sick and healthy lambs.

Vaccination: A closely followed, good vaccination programme is essential for good biosecurity. An important aspect of such a programme is administering the necessary vaccinations on time. Ensure that the appropriate vaccinations are given four to six weeks before lambing, and that your vaccination programme is strictly adhered to.

Clean environment: Do not allow the maternity ward to become contaminated. This will give the lambs the security of a clean environment during the most susceptible time of their lives.

Movement: Move between pens in logical fashion. Move from younger to older lambs, and from healthy to sick lambs. Younger lambs have not yet been exposed to certain organisms, and it is better to maintain this status quo for as long as possible to allow for gradual exposure. For example, stepping on the manure of older lambs and carrying it into a young lamb's pen will speed up the process unnaturally, exposing the young lambs unnecessarily and overwhelming their immune systems.

Good hygiene: Wash hands regularly, wear clean shoes and clothes, make sure the animals' water and food are clean, rotate the pens and keep them clean. Wash your hands between each pen or row of pen and always pay attention to what you may have stepped on before moving to the next pen.

SOURCE

- Brits, M. 2017. Biosekuriteit in intensiewe lamstelsels.

3.2.4 Biosecurity in the semen industry

One of the major risks facing a livestock producer is using semen that has been collected elsewhere but does not meet certain standards. One of the main reasons why artificial insemination (AI) brought about an industry response was the dramatic increase in sexually transmitted diseases among livestock in the 1950s. Today, this is still just as important. Many other diseases such as brucellosis can also be spread through semen.

Before importing semen from countries such as America, Australia and those in Europe, it is imperative to first comply with a list of health regulations. In South Africa, the *Livestock Improvement Act, 1997 (Act 60 of 1997)* contains and regulates the requirements that persons, centres, and bulls must comply with regarding semen collection. From a consumer perspective, in-depth knowledge of the law is nowadays mandatory. The Registrar of Livestock Improvement regulates all AI and livestock improvement issues in South Africa. The process is carried out in collaboration with relevant role-players in the livestock industry.

It is the duty of every individual in the livestock industry to report any substandard/illegal bull semen collection to the registrar. It is also the duty of every individual to ensure that buyers purchase bull semen from a registered semen producer/dealer only. A register of those who qualify is available from the registrar.

The industry has a watchdog in the form of the Animal Genetics Traders Association (AGTA), which represents leading semen distributors within the industry.

All imported semen must meet minimum health and quality standards, as indicated on the import permit. This permit prescribes health standards and the tests that must be performed on donor bulls.

Most of the complaints on farms regarding biosecurity in the cattle industry relate to uncontrolled and untested bulls. In addition, very few producers test for sexually transmitted diseases. Most producers who collect semen themselves are knowledgeable enough not to take shortcuts and not wash sheaths. Very few people are properly equipped to collect and freeze good quality semen. In addition, very few people can properly evaluate semen. It is more complicated than just studying it through a microscope.

Another factor to consider is the use of bulls. Natural mating represents approximately 38% of the market and is subject to much less regulation than bulls tapped for semen sales.

The Registrar of Livestock Improvement is currently responsible for the application of the *Act*. The various breed societies resort under him, and he has the power to delegate to them the responsibility of genetically screening bulls.

It is the responsibility of the National Department of Agriculture to ensure that all genetic material (both local and imported) meets the standards set out in the *Act*. These standards are in line with the standards in most first-world countries.

Although there are restrictions on imports from several countries due to import protocols not being in place, there are quite a few countries from which imports are possible. This fact is acknowledged by AGTA, which represents approximately 90% of the bovine semen importers in South Africa, and imports both dairy and beef cattle semen. AGTA also works very closely with the registrar, the Department of Agriculture, as well as breeders' societies to comply with import regulations. AGTA also imports semen at the request of breeders.

SOURCES

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- Hofmeyr, I. 2025. Stand van vleisbeesgenetika in die land.

3.3 FACILITIES

3.3.1 Fencing and camps

Fencing your farm can be considered a social management tool with various objectives, such as demarcating your property, protecting land use between crops and livestock, as well as managing conflict between humans and wildlife.

In South Africa, the laws that address the fencing of property are the *Game Theft Act, 1991 (Act 105 of 1991)*, the *Fencing Act, 1963 (Act 31 of 1963)*, the *Stock Theft Act, 1959 (Act 57 of 1959)*, the *Animal Diseases Act, 1984 (Act 35 of 1984)*, the *National Environmental Management and Biodiversity Act, 2004 (Act 10 of 2004)*, the *National Environmental Management Act, 1998 (Act 107 of 1998)*, the *National Parks Act, 1976 (Act 57 of 1976),* and the *South African Roads Agency Limited and National Roads Act, 1998 (Act 7 of 1998)*.

One of the secrets to a successful camp fence is the fence's foundation. This means the anchor poles and support poles must be properly spaced and set in concrete.

Anchor poles must be planted at least 750mm deep and set in concrete. Support poles must be set in the ground at an angle of 30 degrees. Many people believe that the support poles must be at an angle of 45 degrees to the anchor pole, but then it loses its anchoring strength and will easily come out of the ground when it rains. The Y-poles can be planted every 10m with the droppers one metre apart.

The droppers are there to keep the wires in place. If they are spaced too far apart, it will weaken the fence. The droppers should also be close enough to each other to keep small stock in the camp and to prevent them from getting through.

How many wires?

In the case of sheep, ten wires at a height of 1,2m should suffice, and for cattle 11 wires at a height of 1,4m should do the job. The bottom wires should be closer to each other and the top wires further apart. The first two or three wires should preferably be no more than 75mm apart. This will prevent smaller animals and predators from climbing through the fence. The wires to the top can be spaced further apart.

Producers who use conventional wire should use mesh fencing with holes that are smaller than 75mm in diameter. It should extend at least 900cm from the ground to the top.

The best and most reliable way to repair fences is by attaching an extra piece of wire to the original wire and then pulling it tight.

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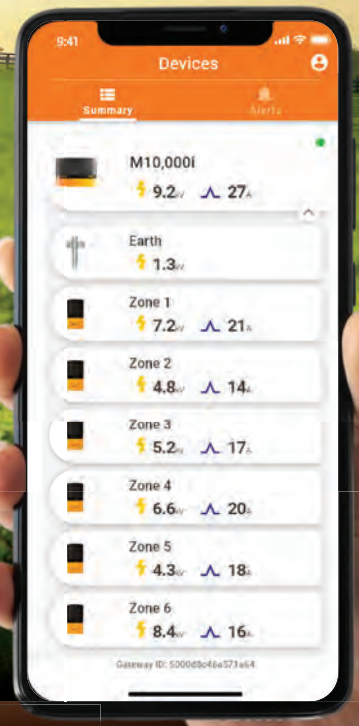

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The University of Tennessee in America has developed guidelines highlighting a number of issues that could assist producers in maintaining their fences:

- Keep the fence wires properly stretched. Fences will naturally loosen over time or with seasonal changes. If tighteners are placed in the fence, check at least twice per year. Other fences may be tightened by resetting or by putting several small kinks or creases in the wire using pliers, a hammer or special tool designed for this purpose. Splice broken wires when necessary.
- Repair or replace anchor post assemblies whenever they show signs of weakness. Refasten loose wires to posts.
- Old woven wire and barbed wire fences which have deteriorated enough to need replacement can be restored to last for many more years by running an electrified wire on one or both sides of the fence through offset brackets attached to the old fence. These offset brackets are made of galvanised high-tensile wire and are easily attached to the existing fence. They should be attached at two-thirds the height of the animals that need controlling, next to posts where they will be held more securely than sagging on old wires in the centre between two posts.
- Use herbicides or manual clearing to keep weeds and vines from covering fences. Grass and weeds touching the wire can ground it and make the fence ineffective for controlling livestock. An inexpensive fence tester should be secured and used frequently to assure proper functioning of the fence.
- A carpenter's apron is very handy for holding nails, staples and small tools, and a good pair of gloves prevents hand injury and helps in gripping wire. Specialised fencing pliers are an excellent investment for anyone who builds or maintains fences.

Electric fencing

Traditional fences will certainly not go out of fashion, but electric fencing is becoming more popular and for various reasons. Note that it is illegal to electrify barbed wire and that it may not be used as earthing in an electrified fence.

For cattle, only three lines are required, of which two are live and the one in the middle forms the earth wire. For sheep and goats, four lines with a height of 900mm and one earth wire are needed.

With regard to predators, a double, short offset is strung approximately 200mm away near the bottom of the fence to keep jackal from entering the camp, while a single, short offset approximately 210mm from the top of the fence will deter caracal and leopards. A trip wire installed on the outside of the camps can assist in keeping burrowers and crawlers such as warthogs out.

An electric fence has four key components:

- The power source supplying electricity to the fence.
- Earthing pins and the earthing system.
- The cable conducting power to the fence.
- The isolators and conductor.

Various power supplies can be used for electric fences, depending on where the farmer needs it. It can be electricity, but batteries and solar power can also be used in remote places. Solar power and two 105-amp batteries can easily allow a large system to function 100% efficiently during two sunless days.

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Eight out of ten problems experienced with electric fences can be attributed to poor or insufficient earthing pins. The earthing system is a vital link in the flow of electricity between the power source and the wire. Without proper earth pins of the correct size and number, an electric fence will not function properly. In most cases failure is due to the size and number of earthing pins having been disregarded.

The conductor is a 2,24mm steel wire used together with a series of isolators, depending on the producer's requirements. Isolators are used for both game and livestock fences, the purpose being to isolate the live wire to prevent short circuits.

It is very important to regularly test an electric fence and make sure that it is functioning properly. Certain factors can cause the energy generator to malfunction, the most common being a short circuit in the fence. Just like a leaking water pipe, electricity is invisible to the naked eye.

Fence testers available on the market provide a reading of the kilovolts (kV) on the fence and indicate the direction of the fault. Should a short circuit occur in the fence, the energy generator will work against itself and if the fault is not repaired, the machine may burn out. Each manufacturer produces its own testers which should preferably be used in conjunction with that specific energy generator.

SOURCES
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- Burger, J. 2016. Toets jou elektriese heinings.
- Marais, S. 2023. Hou jou heinings regop en heel.

3.3.2 Handling facilities

Reducing stress when handling animals is to every producer's benefit. Firstly, it is much easier to work with calm animals and secondly, stress tends to suppress the immune system.

The most important chores on a livestock farm are performed in the kraal. Well-equipped kraals and pens are therefore worth your while. Building proper handling facilities can be costly, but producers who have done so, will tell you how much easier this has made their work. They now need fewer workers, and they can handle more cattle per day.

When it comes to the handling of livestock and the design of an efficient crush, it is beneficial to everyone that the animals are handled in a way that causes as little stress as possible. The facilities should therefore be adapted to mimic the natural behaviour of the animals.

Principles for stress reduction

Over time, several fundamental principles have been identified for reducing stress in livestock by taking their natural behaviour into account:

- Animals should not be forced to do something they do not want to or for which they are not ready.
- Set up the situation in such a way that your idea becomes their idea.
- Animals want to see what or who is putting pressure on them.
- Animals want to see where you want them to move.
- Animals want to move past or around you.
- When under extreme pressure, animals want to move back in the direction they came from.

Some of the most important behavioural patterns to bear in mind are that animals remember bad experiences. Well-designed facilities keep them calm and make handling much easier. Cattle are especially sensitive to rough handling.

Cattle tend to look for an escape route when they enter a kraal. The kraal must be designed in a way that allows them to view the next gate which they are approaching, as their 'escape route'. When designing a handling facility, it is essential to consider the fact that surrounding noise, shade, water holes and moving objects make cattle nervous and therefore reluctant to enter the facilities.

It is important to use an S-shaped crush inside the kraal, as it reduces stress levels. According to behavioural specialists, animals want to return to the place where they were comfortable. A curved crush creates the false impression that they are returning to where they were comfortable.

Size and form

Fresh water, electricity, and location are important. All wire fences and unnecessary gates should be removed from existing facilities.

Decide beforehand how many animals will be handled daily. If, for example, you plan to work with 100 cows with calves, you will need approximately 4m² for each pair. The kraal must therefore be approximately 20 x 20m. For market-ready heifers, 2m² per animal will suffice.

It is more cost-effective to build a round or square kraal. It is also vital to decide which activities the kraal will be used for, because it should be equipped accordingly. It can include dehorning, branding, deworming, weighing, and loading of animals.

Research has shown that a round facility prevents the formation of corners where animals will keep on milling in circles instead of moving forward. Consider everything – the height of the kraal, the width of the crushes, entry gates, slope and surface of the floor, location of the kraal on the farm, as well as sufficient room for trucks to load and off-load and turn around. Smaller holding camps should be part of the layout.

Kraal design

Four areas should be included in the design:

- An area where the animals can be kept together (**holding pen**) without them becoming stressed. Long, narrow holding pens work well as the animal will not be able to run past you because it spotted a flight zone.
- A **crowd pen**. This pen should preferably form a full or half circle, with one or two rotating gates closed with plates, so that the animals can't see each other. This assists in them moving to the crush more easily, as they see it as their only option.
- A **crush or race** where the work is done. Give this structure solid sides so that the animals cannot see the movement and activity of workers and other animals. The floor surface of the crush should be of rough cement so that the animals won't slip and will feel safe. The top poles should be well spaced so that you can easily put your arm through to reach the animal, and so that your arm doesn't become trapped when the animal moves to or fro. The spacing

should be of such a nature that when the animal puts its head through it, it can easily pull it back. The crush should also allow for easy pregnancy examinations by the veterinarian. The crush should accommodate 12 to 15 cattle, and have a length of 18 to 20m, and a width of approximately 750mm.

- A **rest/recovery pen** to hold the animals after they have been processed.

Suitable material

Structures such as posts, gates, or fences must be properly maintained so that animals are not injured. Use only good quality materials to construct them.

Most kraals in South Africa are built from steel. Mobile pens are also very popular and help to care for animals in the veld. This saves a lot of time when important actions such as vaccination are carried out on extensive farms. These pens can be easily screwed together and is a good fit for producers who cannot buy and erect the complete layout at the same time.

SOURCES

- Du Pisanie, K. 2016. Proper kraals are always a good investment.
- Du Pisanie, K. 2022. Livestock handling facilities for easier work and calmer animals.
- Hofmeyr, I. 2023. Laestres veehantering uit die dier se oogpunt.

3.3.3 Shade and shelter

During the South African summer, daily maximum temperatures in most parts of the country can rise quickly and heat stress can set in. Trees provide a good solution for the extensive producer who wants to ensure shade at the watering areas in the veld. However, trees take time to grow and provide sufficient shade.

While trees offer a cheap option and cattle prefer the shade of trees to man-made structures, it also has some disadvantages. For one, trees can die as a result of bark being stripped off. To protect them, they can be fenced off on the shaded side. This is, however, not very effective as the shade then becomes restricted.

Water and feed must also be located close to the trees, otherwise the animals will not ingest sufficient amounts. However, water troughs should preferably not be placed beneath trees, as the water can be contaminated by leaves.

Man-made structures offer a long-term solution. Shade net offers a good solution for shade in the veld, but is not as durable as, for example, corrugated iron or zinc sheeting. The latter is preferable for structures erected close to the workplace, such as milking parlours and feedlots. In both cases, provision should be made for medium- and long-term maintenance of the structures.

Despite high steel prices, a good structure does not have to cost an arm and a leg, and various do-it-yourself products are available on the market, with pre-moulded galvanised components that offer good value for money.

Size of structures

According to a study conducted at Elsenburg, structures should be located a comfortable distance from feed and water troughs. The structure should also allow at least 4 to 5m^2 of surface area per cow. A smaller structure will cause animals to crowd underneath the roof as well as promote excessively wet soil. Animals may also struggle to lie down due to crowding.

The length-to-width ratio is a key consideration. A structure should therefore not be wider than 12m, as this limits airflow underneath the roof. The height of the roof is equally important and at least 2,5m is recommended to ensure good airflow.

Shelter at the feed trough usually causes crowding and it is vital to add a large cement floor that covers the area surrounding the trough. However, these floors are often too small, which may lead to hoof injuries. The cement floor and the ground should also be level with no step in-between.

Shade in a sheep feedlot
The easiest way to prevent heat stress in a sheep feedlot is to provide sufficient shade. This can be done by stretching a shade net across the centre of the kraal. An area of 0,7m² per sheep and a height of 2,5m is ideal. A good source of clean, fresh water is essential, and water troughs should preferably be cleaned and refilled daily.

Theories regarding colour
The colour of a structure also plays a major role. It has been proven that coloured corrugated sheeting has a longer lifespan. The producer can use coloured corrugated sheeting or paint it himself. Using factory-painted sheeting is more economical and the product will also last much longer than going the do-it-yourself route. The ideal is to paint the rooftop white so that it reflects direct sunlight.

Choose wisely when you decide to paint it yourself. The sun's convection heat can be reduced by erecting a high enough roof, which will allow the wind to disperse the heat. Thermal radiation, which makes up the largest percentage of heat, can be reduced through insulation, such as a ceiling.

Direction of the structure
Apart from the fact that the sun, which moves from east to west, plays a pivotal role, rain and prevailing winds must also be considered. The structure should preferably run east to west as this will provide the most shade. Producers are increasingly using these constructions for solar panels and in this regard, structures should also run east to west, with the panels pointing in a northerly direction to catch the sun.

Shade nets
Cattle and sheep production can theoretically increase by as much as 40% when using shade structures close to animals' water points. Research has shown that when Merino sheep have access to shade, their production increases. Research also showed that newborn lambs' birthweight and survival are improved when the ewes have access to shade during late gestation (Cloete, Muller and Durand, 2000).

Three key factors must be kept in mind at all times when erecting shade net: the thickness of the poles, the density (or percentage) of the shade net, and the method of attaching the net to the structure.

The height of the structure also plays a big role. A structure that is too low and a shade net that is too dense can lead to the area underneath the net becoming warmer than in open areas. A structure of approximately 3m high is recommended to allow the wind to pass underneath it; it should be anchored between 600 and 800mm below the ground to keep the structure firmly in place.

SOURCES
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- Du Preez, E. 2023. Hittestres in skaapvoerkrale: Voorkoming en bestuur.
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3.4 FEED AND WATER TROUGH MANAGEMENT

3.4.1 Dominance and trough placement

Aggressive behaviour and dominant hierarchies are intertwined with animals' natural survival. Dominance refers to the social hierarchy in a herd, where each member of the herd has a specific place and position in the herd. Aggression, on the other hand, is specific behaviour aimed at reaching a specific goal, such as enforcing dominance or getting to the feed trough in a feedlot situation.

The more intensive the system, the more noticeable the aggressive behaviour becomes. This type of behaviour will emerge in feedlots and places where feed or lick is being placed in troughs, even in the veld. It even occurs on veld and pastures where grazing is diminishing, and the more dominant individuals push others away from the grass.

There are several common causes of aggression within a herd, of which the availability of trough space is one.

Factors determining trough space

- **Gender:** Cows and heifers are less aggressive than bulls.
- **Age:** Older animals, especially cows, may dominate heifers, but the same applies to long weaners and weaner calves.
- **Social hierarchy:** A group of weaner calves from one farm already has an established hierarchy. If you mix such a group with a group from another farm, a new hierarchy must be determined.
- **Trough skills:** Cattle that have experience in feeding from a trough will need less trough space than animals that haven't yet eaten from a trough.
- **Horns:** The presence of horns and their length play a role. Horns double the trough space requirement because an animal with horns can keep the others away from the trough. The longer the horns, the bigger the trough space must be because of the range of the horns.
- **Ration:** A ration that contains ingredients to control intake, will require less trough space than a complete ration where the animals have to spend more time at the trough.
- **Feeding period:** Cattle that have been fed for some time need more trough space because they are bigger than smaller animals that have been fed for a shorter period.

Trough design

The most important factor in trough design is access. Is there a wide, hard area where the animals can stand when feeding, or is the trough surrounded by slippery mud that limits access? Easier access means less aggression.

The physical design of the trough also plays an important role. If the trough has inaccessible corners where feed can collect it will increase aggression, and provision will have to be made for more trough space. A trough with curves, on the other hand,

makes it easy to reach the feed, as every animal feeds for a shorter period and moves on to make space for another animal.

Troughs are often equipped with an iron bar that prevents animals from physically climbing into the trough and polluting the feed with mud and manure. However, if the iron bar doesn't leave enough space for the animal's head and to reach the feed easily, it may also lead to aggression because the animals can't get to the feed.

Troughs must be able to drain properly. If rainwater isn't able to drain from the trough quickly, it reduces the trough space considerably because the feed becomes unpalatable where water gathers.

Feeding frequency

The more often fresh feed is put out, the lower the levels of aggression will be. Usually the dominant animals feed first, then the next group, and the timid animals last. If the feed runs out before the last group feeds, the dominant animals will naturally be in front again during the next round. If enough feed is given regularly and the feed never runs out, every animal will get a chance at the trough.

Something to keep in mind is that every time the animals receive fresh feed, it will attract animals to the trough. So, although the dominant animals have already fed, they will return to the trough every time fresh feed is delivered.

Feeding protocol

Animal feeding has a natural rhythm called the daily rhythm. Animals in the veld, including cattle, feed mostly at sunrise and again at sunset. This natural rhythm must be kept in mind when feeding animals under artificial circumstances, because this is also when aggression will be at its most prevalent.

There are several common causes of aggression within a herd, of which the availability of trough space is one.

Feeding space and interaction

The smaller the space per animal in a kraal, the greater the urge to dominate and exhibit associated aggression.

Social hierarchy

In any herd there is a social hierarchy of dominant animals. In stable herds the hierarchy has been determined, and it is relatively peaceful. Calves born into such a herd also determine their own hierarchy while playing.

However, if you were to gather the cattle and sort them into new groups, a new hierarchy must be determined. This causes stress among the animals and can lead to injuries. It is important to allow a new herd time to determine its social structures.

Within the social structure, dominance is determined by factors such as age, gender, size and weight, health status, and the environment. It is interesting to note that a group of animals that move from one kraal to another will re-establish dominance within the group.

The hunger factor

Besides all the aspects mentioned here, one must never forget that hunger is the biggest driver of aggression. Even animals lower down in the dominance hierarchy will, if they are hungry enough, do what is necessary to reach the trough. This is when the difference between dominance and aggression becomes clear – hunger is a strong driver of aggression.

There are a few reasons why one has to be aware of aggression and dominance in the herd, the first and most important reason being a drop in production. This also increases digestive and metabolic issues

such as acidosis – especially subclinical acidosis. These conditions, and especially subclinical acidosis, will rob you of your income as they quietly erode your production figures.

Effective management

It is possible to achieve success with less-than-ideal infrastructure, such as insufficient trough space, but then you have to be sure that your management is spot on. The only way to manage behaviour and good feed ingestion effectively, is to be aware of the various factors that can influence animal behaviour in the kraal.

SOURCE

- Hofmeyr, I. 2014. Who's the boss?

3.4.2 Feed trough management

Good feed intake and trough management tend to benefit animal performance as they will ingest sufficient protein and energy. One should be careful not to apply old rules of thumb to modern-day expensive feeding systems, such as always feeding 5 to 10% more than animals ingest.

Livestock in intensive systems prefer consistency to produce maximally:

- All the feed in the trough should be uniform.
- The feed in the trough should always be fresh.
- The feed should be chopped to the ideal length, depending on the type of animals being fed.
- Feed troughs should be cleaned daily, as dirty troughs reduce intake and affect feed conversion.
- Feed during optimal times of the day (not too much feed in the middle of the day during midsummer; rather give more at night during hot months).
- Monitor feed troughs before unloading the next fresh feed and adjust the volumes daily according to the previous 24 hours' intake.
- Continuously evaluate all animals' behaviour at the feed troughs.
- Implement a feed trough evaluation system.
- Ensure sufficient trough space.
- Feed trough dimensions must be ideal for the species being fed.

Be observant

Always keep an eye on animals at the troughs, because if dominant animals push the weaker ones out, the performance of the latter will suffer even further.

Feed should always be fresh, and its temperature must not exceed 50°C. Should this happen, feed intake will decrease, and animal performance will deteriorate.

It is important to develop a feed trough evaluation system so that feed troughs are filled optimally daily. An example of such a system is one developed in 2003 by Pat Hoffman at the University of Wisconsin:

0	Only cement or bottom of the trough visible (all feed eaten).
1	Only a few pieces of feed are visible here and there, therefore most of the bottom is visible.
2	A lot of feed is still in the trough, but the bottom/cement of the trough is visible.
3	Bottom of the trough is not visible, but the feed layer in the trough is no more than 25mm.
4	Bottom of the trough is not visible, but the feed layer in the trough is thicker than 25mm.
5	Feed has not been consumed at all.

The ideal score for replacement heifers over six months, feedlot sheep, and feedlot cattle is a trough score of 4 when feeding heifers, but at least once a day (usually in the middle of the day), a trough score of 1 for a maximum of one hour (no longer, as the animals will get hungry and overeat during the next feeding).

Most feedlots follow a strip feeding policy and therefore the troughs are regularly filled with feed to approximately 100mm deep. This type of strategy ensures that feed remains fresh; however, trough management and evaluation are critical to ensure that animals never run out of feed.

Space per animal

The next important aspect of trough management is the trough space per animal, which is largely dependent on the feeding system and the type of animals having to be fed. The type of roughage, its moisture levels and chop length, the number of rations per day, and the type of mixer used are just a few aspects that influence individual feed trough space.

The following guidelines are normally used to determine feed trough space – note, however, that it remains important to do the calculations based on your own situation and environment:

- **Replacement heifers aged 5 to 8 months:** minimum 450mm/animal (large-framed breeds and once-a-day feedings).
- **Replacement heifers aged 13 to 24 months:** minimum 650mm/animal (large-framed breeds and once-a-day feedings).
- **Beef cattle in a feedlot:** minimum 250-300mm/animal.
- **Sheep feedlots:** minimum 200mm/sheep (meat breeds).

SOURCE

- Botha, K. 2013. Voerkripbestuur kan marge verbeter.

3.4.3 Creep feed structures

Any creep feed system must be designed to meet the farm's specific requirements. Every farm is unique and therefore the design has to be of such a nature that the producer can move and alter gates to suit his particular situation.

It is important to consider every possible aspect that can influence the success of creep feed when planning how and where to put a creep feeder. These include the number of lambs that are going to feed at the feeder, the space the lambs will need in order to have an even chance at getting to the feed, and where it should be placed.

Lambs must feed simultaneously and feeding space must therefore be sufficient for all of them. Where feeding space is limited, only the strong lambs will feed and the smaller ones that actually need the

creep feed more, won't be able to get to the trough. This leads to large-scale feed wastage and figures that don't add up.

A creep feeder plan

The first step when building a creep feeder is to decide where you are going to place it. It is important to remember that the feeder must be close to a watering point, where the sheep will flock together for most of the day:

- Start with a feeding trough and place gates around it in the shape of a tennis racket.
- Place creep railings on one side of the structure. The creep railings must be 3m long and 900cm high, with creep space of 18cm.
- The racket's head must also have gates that are 3m long and 900cm high, with one or two extra railings for easier access to the feed.
- For shade and protection against rain and dew, place a corrugated sheet on each side of the trough. The corrugated sheet must be placed so that it will give shade against the creep railings, so as to lure the lambs into the shade.
- Make sure there is enough space inside the trough so that all the lambs can feed simultaneously. The creep feed can be put into the trough, and the lambs can feed from both sides.
- The structure is built in such a way that it provides sufficient space on both sides of the trough to allow lambs to pass other lambs already feeding in order to reach an available trough.
- Make sure that the feeding troughs are deep enough to prevent lambs from spilling the feed and wasting it.
- The following day's feed can also be stored in the troughs. A horseman or worker on foot can put out the feed, thus saving the expense of bringing the feed with a vehicle.

The purpose of a creep feeder is twofold: to prevent ewes from eating the high-quality creep feed and to teach the lambs to feed. In nature, lambs learn to feed on grass by eating next to the mother's mouth. The creep feeder lends from this method and therefore it is important to lure the ewe to the creep feeder as well:

- Place a lick drum with feed and lick in front of the creep gate.
- Place a feed trough inside the creep gate with about 20cm wire. The feed trough must be in the shade as well. Leave a space of about 18cm where the ewes can put their heads through to feed in the shade. If you use lambing pens, use the same feed trough that you use in the lambing pen.

The ewe will come closer to feed from the lick trough, see the feed trough inside the railings, put her head and neck through the opening, and feed from the trough inside the structure. The lamb/s will follow the ewe to suckle. They then creep through the railings to where the ewe is feeding. There it finds shade, makes itself at home and will soon enough feed from the trough and explore the creep feed camp.

The gate system

Most small-stock producers make use of the 'gate system' where the lambs access the feed through openings in a fence or gate. It is big enough for the lamb to fit through, but too small for the ewe. Openings should be approximately 20 to 30cm wide for large-framed breeds and lambs that are weaned when older. The height of the openings tends to vary between 40 and 50cm.

It is preferable to have several openings so that lambs can access the creep area from both sides and, where possible, openings should be adjustable

to accommodate growing lambs. The inside area of the pen should be around 0,25 to 0,4m^2 per lamb, so that several lambs can enter simultaneously. Creep gates must be at least 1m high to prevent ewes from jumping over it.

When putting out creep feed, use a feed trough or self-feeder that can protect the feed from rain and prevent the lambs from climbing into it. Adequate feeding space is essential to ensure that all lambs have access to the feed. The recommended feeding space is 5cm per lamb, but it can be less (minimum of 3cm per lamb) where self-feeders are being used.

The creep feed pipe system

An alternative method is the so-called 'creep feed pipe system'. This system does not require creep gates as the lambs can access the feed in the pipes while the ewes are present. The holes in the pipe are large enough to allow the lambs to access feed at the bottom of the pipe, but small enough to restrict the ewes to the top half.

Initially, the pipe can be filled to the top with ewe and lamb lick, allowing the ewes to teach the lambs to eat the feed. Later on, only the bottom half can be lined with creep feed, thus preventing the ewes from reaching the feed.

Any polyvinyl chloride (PVC) or steel pipes 25 to 30cm in diameter can be used for this purpose. The holes should be 14 to 15cm in diameter. The holes can also be designed to accommodate horned lambs. A 3m pipe has enough space for roughly 15 holes spaced approximately 4cm apart, allowing adequate feeding space per lamb.

When using large diameter pipes, holes can be made on either side of the pipe to accommodate more lambs (up to 30 per pipe). It is best to add a base to each side of the pipe to prevent it from rolling over and the feed from spilling out. The pipe system is cheaper than the gate system and is easier to move.

The same principle applies when using drums. One 210ℓ drum, cut in half, provides two feed troughs, each with enough space for eight holes of 15cm each in diameter. A lid will protect the feed from rain, and holes can be made in the bottom to promote water drainage.

SOURCES
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3.5 WATER

3.5.1 Water legislation and quality

The *National Water Act, 1998 (Act 36 of 1998)* is highly relevant for the agricultural industry and modifies the traditional use of water – this also applies to some livestock producers. Producers who contravene this law not only face a stiff penalty, but also imprisonment.

DID YOU KNOW?

Authorisations or water licences for all water uses affecting rivers, streams and wetlands are valid until August 2036.

The agricultural sector's overall water consumption, which has been subject to registration with the Department of Water and Sanitation (DWS) in terms of Section 21 of the *Water Act*, mainly involves:

- Extraction of ground or surface water.
- Storage of water in a dam.
- Activities that obstruct the flow of water in a river or stream, divert it and change the bed, banks, or flow.
- Activities such as forestry that reduce stream flow.
- Using treated wastewater for irrigation.
- Using any water drainage system for dumping wastewater into a water source.
- Dumping of waste materials and water that may have an adverse effect on ground or surface water.

The type of water uses on a farm that are subject to approval are therefore varied. However, this does not mean that each type of water use requires its own authorisation or licence. The DWS usually process only one application containing all the different water use types and then issues one integrated approval for the farm.

Producers are also generally under the impression that a copy, certificate or any other documentation issued by the DWS serves as registration of water use and therefore makes water use legal; however, this is not the case. The successful registration of water use is an indication that the DWS is aware of a need to use water, and that an allocation has yet to be made that will legalise the water use.

When is no authorisation required?

According to the *Water Act*, water for reasonable domestic use, domestic gardening, water troughs for livestock, firefighting, and recreation has a limited influence on water resources and no authorisation is therefore required. Livestock producers not operating a feedlot or abattoir, cultivating pastures under irrigation, engaging in other operations as mentioned, or running more livestock than the official carrying capacity of his/her farm do not need to obtain authorisation to use water.

Without the necessary approval, anyone contravening the legislation's provisions is guilty of an offence. In terms of a first conviction, a fine can be imposed or the offender can go to prison for a maximum of five years. In the case of a second conviction, the fine increases exponentially and a prison sentence of up to ten years can be imposed.

Anyone can apply for permission to use water. Although seemingly straightforward, it is in fact a complex process that can often be overwhelming. It is best to make use of knowledgeable consultants. This way, the applicant will be spared a lot of frustration and save a lot of money.

The term of authorisation

Authorisation or water licences involving all water uses pertaining to rivers, creeks and wetlands are valid until August 2036; the withdrawal and storage of water are valid until September 2036. There is no validity period linked to waste materials, wastewater, and related uses.

However, a water consumption licence can remain valid for extended periods, depending on what the applicant has applied for. In IWULA's experience such a licence can be valid for up to 40 years. A licence holder can apply for a renewal or amendment to the DWS before the licence expires.

The same norms that applied during the original application must be considered for the amendment or renewal thereof. The department can also amend any condition

of the licence by means of an agreement with the licensee.

Drought affects water quality

Water quality decreases and pollutants increase during drought. Some of the compounds in the water can affect the performance and health of cattle and sheep. Water with high levels of total dissolved solids (TDS) can reduce animals' daily feed intake, and water with a TDS that exceeds 5 000 parts per million (ppm) should not be given to livestock.

Several studies have shown that water with a TDS of 4 000 to 5 000 ppm used in a feedlot has a negative impact on cattle growth. Moreover, it leads to a drop in lactating cows' milk production, resulting in lower weaning weights.

Nitrate pollution caused by manure and fertilisers is a growing concern. Water with a nitrate level of 300 ppm is considered unsafe, which can lead to animal mortalities if consumed. However, chronic toxicity, which causes animals to ingest less feed and affects performance, is the biggest concern. Producers must ensure that no manure and runoff from fields end up animals' drinking water.

Sulphur, iron, and manganese are other minerals that can affect the quality of drinking water. High levels of certain minerals in the water limit the absorption of trace minerals – for instance, high iron and sulphate levels can limit the absorption of copper and zinc.

The temperature of the water also has an impact on livestock performance. Cool water assists in maintaining normal body temperature; animals are also more inclined to consume enough water if it's at an optimal temperature. Blue-green algae reduce water quality and are usually found in water rich in nutrients. These algae are bacteria that, under the right conditions, can produce toxins that can kill animals.

SOURCE

- Gouws, A. 2024. Water use and water legislation: How does it affect the livestock producer?

3.5.2 Water on the farm: Dams and boreholes

The importance of clean drinking water for livestock cannot be stressed enough. In fact, many animal nutritionists consider water to be the most important nutritional element there is. The question arises as to what type of water sources, natural or man-made, are available to livestock producers. Four sources and distribution methods are discussed here.

Boreholes

Apart from springs and wells, the only way to access groundwater is by sinking boreholes. There are numerous drilling techniques that can be used to successfully drill through various geological formations. Nowadays, using modern, advanced air-powered drilling machines, it is not unheard of to complete a 100m deep borehole in a single day.

Before equipping the borehole with a pump, the producer must ascertain what the sustainable yield of the source is. Once water has been found, the driller will

usually test the yield. Most pump equipment suppliers can also carry out these tests, and the borehole is then subjected to pumping conditions that are much more intense than the ultimate operating rate will be.

The water from such a borehole is pumped to a reservoir or tank, from where it is used for livestock water sources or household purposes via a pipeline.

Earth dams

The purpose of an earth dam is to collect and store water for future irrigation, livestock, or domestic use and often also to water farm gardens. The earth dam can be fed by surface runoff water, permanent springs, water rationing such as for irrigation schemes, and permanent streams.

The design of an earth dam wall is not discussed here, but it suffices to mention a few conditions that must be considered when designing such a dam, especially where the stored water is to be used for livestock:

- Where an earth dam is rainfall dependent, the catchment area and annual runoff must be considered so that not too big a dam is built. The dam's storage capacity must be able to meet the water needs of a livestock herd for at least six months. Also pay attention to the condition of the catchment area so that silting does not occur
- The construction site must be technically and economically suitable.
- The location of the construction site should be such that it fits into a sound grazing management system.
- Ensure that the dam wall and core are built according to existing standards using suitable materials to prevent seepage through the dam wall or through the dam basin.
- The dam wall, dam basin, and outlet should preferably be fenced off.
- Evaporation losses should be limited and therefore care should be taken not to build big, shallow dams. The surface area of the dam should be as small and as deep as possible.
- The earth dam should be fitted with an outlet pipe so that the water can be drained if necessary. The diameter of this pipe should be at least 150mm.
- Build separate concrete or cement drinking troughs. The diameter of the pipe supplying the troughs through the wall should not be smaller than 50mm. The drinking troughs must be constructed or installed where they can be easily accessed by the livestock, and especially in areas where the terrain around the drinking troughs won't be trampled.

Round storage dams

Three types of round storage or reservoir dams usually built on farms are concrete, masonry, and prefabricated zinc reservoirs. When planning to build or erect these types of dams, the following aspects are particularly important:

- The choice of building site, especially the appearance and characteristics of the soil on which the foundation will be poured. Avoid a building site characterised by uneven bearing capacity, such as dense gravel or rock in one place and soft soil in another.
- Always use good materials such as fresh cement and evenly baked bricks to ensure that seepage through the embankment is limited. Water seepage weakens the steel reinforcement used in the walls, causing the dam to fail.
- It is always good to have a proper plan drawn up for the construction of a concrete or masonry dam, especially regarding the choice of concrete mixtures and the type of reinforcement to be used. Such plans are available from the Concrete Institute or ARC-Agricultural Engineering.
- Zinc dams are often erected where water contains aggressive salts that cause cement or concrete to deteriorate or where building sites are remote, and the cost of transporting building materials is high or problematic.
- The same precautions as previously mentioned, must also be taken with the foundation of a zinc dam.
- The advantage of a zinc dam is that it can be erected quickly once the foundation has been poured.
- When erecting zinc dams, special attention must be paid to the way in which the zinc is fixed in the foundation.

Livestock watering systems

When designing a livestock drinking water system, there are two animal behavioural preferences to keep in mind. If the water source is located more than 100m from the grazing area, the animals will come to drink as a herd rather than individually. This behaviour has a definite influence on the design of the water supply to the troughs.

Another 'law' that applies to animals is that they tend to remain close to a water source. Grazing located near troughs will therefore be grazed repeatedly instead of the animals moving to better grazing areas in another camp. The movement of animals and their grazing habits can be manipulated by placing watering troughs in a camp. This allows for a better grazing pattern to be established, while urine and manure can be distributed more evenly across the camp's surface.

Reference was previously made to different types of water storage areas, and these sources can now be provided with a distribution network to the watering troughs. Such a system can consist of plastic pipelines, pressure relief valves, and even buffer reservoirs. The design of such a system will consider the topography and water requirements of livestock.

The amount of water required at a water trough is determined by the number and type of livestock that will use it.

Water requirements of livestock

A number of factors influence livestock's daily water requirements. This varies from region to region. *Table 3.3* illustrates livestock's water requirements under normal conditions.

Table 3.3: Livestock water requirements under normal conditions.

Livestock type	Requirement/head/day
Small stock	5 litres
Large stock	50 litres
Lactating dairy cows	90 litres
Ostriches	10 litres

Types of drinking troughs

Two types of drinking troughs are commonly found on livestock farms, namely round drinking troughs and elongated drinking troughs.

The round water trough is constructed in the same way as a round storage dam. The round drinking trough has the advantage of not cracking as easily as an elongated drinking trough and is usually cheaper per litre of capacity. However, producers generally prefer elongated drinking troughs.

The amount of water required daily at a drinking trough is determined by the type and number of livestock drinking there. The daily drinking period is determined by the grazing habits of the livestock and especially by the strategic placement of drinking troughs in camps. Generally speaking, the supply network should be able to meet the livestock's entire water requirement in a camp within a short period of time. For design purposes, a period of four hours or 5ℓ/hour/cattle is suggested.

SOURCE

- Le Roux, K. 2013. Water op die veeplaas.

3.5.3 Boreholes and groundwater

Unlike surface water, groundwater isn't visible, and it is precisely this characteristic that makes groundwater so extremely vulnerable. Apart from pollution that threatens groundwater, the sustainability of our groundwater resources (aquifers) is directly dependent on two main, related aspects: volume recharge and volume withdrawal.

Did groundwater originate from rainwater that settled into underground aquifers over centuries? Or does it come from the last few years' worth of rainfall? Both are correct, but because we have traditionally always drilled shallow holes (<150m) the latter is nowadays more applicable.

Our producers are used to their boreholes giving a 'weaker' yield outside the rainy season and 'stronger' after good rains have fallen. Producers who have sunk boreholes near rivers are also very aware of the fact that the holes are weaker when the river is dry or the flow is low. They therefore know that the surface water in the river recharges the groundwater to a greater or lesser extent.

Because producers understand their boreholes and surface water so well, they know when to pump less groundwater in order to protect the source.

Climate change

The effects of climate change take on many forms, including drought, thunderstorms, floods, strong winds, and extreme temperatures. All of these factors, combined with the growing demand for groundwater and a lack of knowledge and proper groundwater management, are putting increasing pressure on the long-term availability of groundwater.

So, what should landowners and major users do? Should we build more dams to capture floodwater, should we make better use of rainwater (e.g. rainwater tanks), or should we drill deeper for groundwater?

The answers lie in all of these and similar approaches. We will need to look at ways to capture available rainwater runoff and stormwater in towns and cities, and reuse greywater. We will have to research better techniques to desalinate seawater. Water users at all levels simply need to understand that water is becoming scarcer and more expensive, and that water conservation measures should be the norm and not applied only during droughts.

Regarding deeper boreholes, the following must be kept in mind:

- Deeper boreholes are much more expensive than shallower ones. The operating costs are also much higher.
- Not every drilling contractor can successfully drill deep holes (>200m).
- The chances of good quality groundwater being contaminated by poor quality groundwater is high.
- Deeper aquifers will not be replenished in our lifetime.

When it comes to water detection, there are only a few geophysical techniques that can 'see' deeper than 200m. Don't be fooled by new, cheap techniques or devices; do your homework first or consult a geohydrologist.

SOURCE

- Nel, G. 2020. Die impak van klimaatsverandering en bevolkingsgroei op grondwater.

3.6 FIRE MANAGEMENT

3.6.1 Legislation and formal structures

Several organisations are involved in fire prevention and firefighting in South Africa.

Forums and associations

The National Veld and Forest Fire Protection Advisory Forum (NVFFPAF) was established by provincial umbrella fire protection associations (UFPAs) to facilitate a co-ordinated approach to fire risk management in respect of aerial and ground operations throughout South Africa.

Provincial UFPAs operate in terms of the *National Veld and Forest Fire Act, 1998 (Act 101 of 1998)*, or the *NVFFA*, by facilitating and co-ordinating fire prevention, control and suppression measures, as well as related risks within the respective provinces and among their affiliated regional FPAs.

The provincial UFPAs participating in the forum are the Eastern Cape UFPA, Free State UFPA, Gauteng UFPA, KwaZulu-Natal FPA, Limpopo FPA, Mpumalanga FPA, North West UFPA, and Northern Cape UFPA.

Stakeholders participating in the forum are Working on Fire (the Department of Environmental Affairs is the custodian of the programme) and the Department of Forestry, Fisheries and the Environment (DFFE), which is the custodian of the *NVFFA*.

Legal obligations of landowners
There are several legal requirements and important principles that are fundamental in the prevention and management of fires.

It is essential to know that, as per the NVFFA, it is a legal requirement to do at least the following if there is a risk that a veld fire can occur and spread from your property:

- Make a fire break along all your boundaries with your neighbours.
- Have firefighting equipment at hand, such as firefighting units, also known as *bakkie-sakkies*, comprising of a water tank, water pump and some fire hoses fitted on to the back of a vehicle.
- Stock water trailers and fire beaters and/or other tools designed for veld fire suppression.
- Make sure you have appropriately trained personnel to fight a fire, should one start on your property.

Steps that producers can take
Landowners are advised to join a registered fire protection association in their area, if one exists. Alternatively, if a group of landowners so wish, they can form one themselves.

There are certain requirements for forming an FPA which are clearly specified in the *NVFFA*. Membership of an FPA is voluntary, as per the *Constitution* which guarantees freedom of association, with the exception of state landowners and municipalities, which resort under a registered FPA. They are obligated to become members of an FPA, if one exists.

One major advantage of being a member of a registered FPA is the presumption of negligence clause in the *NVFFA*. In short, it states that if you are not a member of an FPA, and a fire starts and spreads from your property and causes damage, you will be deemed negligent until you prove otherwise. The *NVFFA* is the only law in South Africa that currently contains this presumption of negligence clause.

Secondly, the FPA will have rules and guidelines to assist its members in being legally compliant. These rules will be deemed to be the 'standard' in a court of law as they are registered, as part of the business plan of the FPA, with the DFFE which is the custodian of the *NVFFA*.

If there is a municipal fire service within the boundary, the chief fire officer should be the nominated and appointed fire protection officer (FPO) of the association, and he/she is responsible for enforcing the regulations of the *NVFFA*, the rules of the FPA, as well as the relevant municipal by-laws if they exist.

Insurance implications
A number of insurance companies are offering various packages for fire risk, which may include fire suppression costs. Insurers are, however, starting to insist on clients being members of an FPA (if one exists) and that they are at least compliant with the law in terms of Chapters 4 and 5 of the *NVFFA*.

It is best to check with your FPA and/or FPO what firefighting resources are available in your area that can assist if required, together with the callout procedures to activate them.

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Prevention actions

These general prevention actions can be followed by both the public and property owners:

- **Prevent accidentally starting a runaway fire** by making sure your outdoor braai or warming fires are properly put out; not throwing cigarette butts out of cars or into bushes or dry grass; and most importantly by not setting off Chinese lanterns, fireworks or flares. Inform all your staff of the dangers of fires in the dry season, and the possible consequences.
- **Protect yourself, your family and animals from injury** by discussing with your family what to do in the event of a fire near your house, who to call and what to do in the case of an evacuation; follow all instructions given to you by the authorities; and most of all, keep well clear of the fire, stay out of the way and do not block or congest any access roads to allow the firefighters to do their jobs. If you want to donate food or refreshments, do so at a fire station or by contacting the fire services or local FPA.
- **Protect your house from damage** by keeping grass cut short; clearing all trees, bushes and dry vegetation away from within at least 10m around houses and structures; and cleaning the roof gutters of vegetation such as dead leaves, etc. In addition, test the sprayers on thatch roofs regularly and, if you are a rural landowner, join the FPA.

Report all veld fires immediately to the local/district Fire Department, your local FPA or call 112 on your cellphone. For more information, visit the website of the National Veld and Forest Fire Protection Advisory Forum at *www.saufpa.co.za*.

SOURCE

- Nortjé, D. 2022. Firefighting and fire prevention: Guidelines, legislation and organisations.

3.6.2 Fire breaks and firefighting equipment

Government Gazette 19515 of November 1998 clearly states that it is the duty of landowners to make and maintain firebreaks. It is essential for every landowner to familiarises him-/herself with its contents.

A few interesting legal points are:

- Firebreaks must be made where wildfires are likely to occur.
- These preliminary fires must be made at least on the boundaries of all adjacent land.
- Regarding firebreaks, the law stipulates that communication with the owners of neighbouring farms is essential, and that the local firefighting organisation must also be aware of it.
- Fourteen days' written notice must be given to the parties involved.
- If the neighbours agree to the planned date, it is their duty to make these preliminary fires on their side on the same day.
- Sufficiently trained personnel must be available on both sides during the preliminary fire.
- If the firefighting organisation opposes the preliminary fire, the action may not proceed.
- If, for some reason, a fire warning is issued, the date must also be postponed.

Ensure that preventive control is also applied where vehicles are involved, as they can become a possible source of fires.

Important points

- The firebreak must be made wide enough so that the spread of fire is reasonably controllable.
- It must not cause soil erosion.
- It is the task of each landowner to acquire the right equipment for wildfire control and firefighting. This includes protective clothing.
- Personnel must be trained in firefighting actions.
- Should a fire break out and any person is of the opinion that it may pose a danger to life, property, or the fire may spread, he or she may enter the property and take the necessary steps to extinguish or control the fire.

If landowners were to disregard relevant legislation by not exercising fire prevention or maintaining fires properly, they may be imprisoned or fined.

Preventive measures

Ensure that preventive control is also applied where vehicles are involved, as they can become a possible source of fires. This includes the proper and safe storage of fuel and related products. This aspect is often neglected, especially during busy planting or harvesting times.

It is an ancient human custom to burn land before cultivating it for the first time. Unfortunately, this practice still takes place today, and often in an irresponsible manner. Be very aware of weather conditions on the day of controlled fires – rather postpone the action to a day that will be more favourable for a preliminary burn. Also be aware of power and telephone lines as well as boundary fences that can be damaged.

Equipment

There are various types of firefighting equipment, the use of which depends on the size of the area to be controlled. Examples of firefighting equipment are:

- Firefighters (high-, medium-, or low-pressure units). These are very effective devices that easily fit onto the bakkie and can hold up to 600ℓ of water in the container.
- Rakes.
- Tractor and plough.
- Fire beaters.
- Fire starters.

Take time to inspect and practice

- Invite the local fire brigade and your neighbours to your farm, so that everyone is aware of the available facilities, and to share advice and criticism regarding fire hazards. Do the same on neighbouring farms.
- Carry out regular inspections of buildings and where fires may start on the farm. This includes employee housing.
- Hold regular drills to control fires. Hold a discussion afterwards to eliminate mistakes. Also inform the residents of employee housing regarding the danger of fires.
- Always keep firefighting equipment in good working order. Obtain a firefighter immediately.
- Carry out preventive maintenance on items that can cause fires, such as long grass near buildings and the like.
- Ensure that all electrical work on the farm complies with SABS standards – this includes installation work. Earthing is sometimes neglected.
- Enforce a 'no smoking' in and near all areas where fire poses a significant hazard.
- Ensure that fire extinguishers are placed in stores and office areas and are adequate for the type of fire that has to be extinguished. For example, chemical firefighting will require different types of extinguishers.

Buy right and on time

Always ensure that there is a properly trained team that can fight fires and that everyone on the team understands their responsibility at the time of a fire, whether it is pre-fire or fighting it. The timely movement of livestock is important and should be part of any fire contingency plan.

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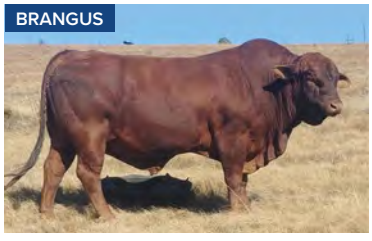
SA ID: BVN11112

BRANGUS

PABLO
SA ID: DD16146

BRANGUS



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4 BREEDING, GENETICS AND RECORD-KEEPING ON THE LIVESTOCK FARM

4.1 BLUP VALUES: THEIR ORIGINS AND USES

Animal breeding has grasped mankind's imagination since the earliest times. You merely have to visit the oldest of the pyramids in Egypt, the 5 000-year-old step pyramids, where the walls testify of this urgency to understand and manage animal breeding. One image tells the story of how a cow is hand-bred. Another wall shows how her calf is born and how she is kept still with a milking strap while being milked. Clearly someone also took control of the decision that a specific bull-cow combination would deliver the best progeny.

Most people know the interesting story in Genesis 29 and 30 that plays out some 4 000 years ago. Jacob fell in love with his cousin, Rachel, but in order to pay for the right to marry her, he was required to tend to the livestock of his uncle, Laban. At first Laban tricked him into marrying the older sister, Leah. This meant that Jacob had to spend another 14 years working as a herdsman for his uncle, looking after his sheep and goats.

However, Jacob and his uncle reached an agreement, in terms of which he would retain the progeny of these flocks. Jacob wanted those with a specific colour pattern (the multi-coloured, striped, spotted and black lambs). But before long, Laban ordered for all breeding animals with these colour traits to be removed from the herd, thus preventing Jacob from breeding these animals.

Jacob nevertheless succeeded in breeding the desired colour pattern by way of hand-breeding. He waited with the rams at watering points and had the ewes covered when they arrived to drink. Two things happened: his own flock expanded much quicker than his uncle's, and he bred the best animals (stronger ewes) for himself.

4.1.1 Jacob's techniques

Jacob started by setting himself a breeding goal (colour pattern and improved animals). He then used a measuring technique by recording which breeding stock possessed the desired traits for a specific colour pattern and bred the best progeny. He also applied a breeding system which ensured that he achieved his goals. Sound familiar?

The three most important steps of animal breeding are:

- **A breeding goal** that is based on economic considerations. These breeding goals are supported by measurable traits exhibiting sufficient genetic variation that can be improved through selection. Minimum norms can now be set for a composite group of traits or for individual traits, before an animal qualifies as a breeding animal. Usually, the norms are stricter for male animals, as fewer are needed for breeding.
- **Genetic merit:** Place all breeding animals in order of desirability in accordance with the breeding goal. In order to achieve this, the animal's genetic merit for the economically important traits should be known as far as possible. Objective measurements together with adapted statistics that consider differences in environmental influences, family performance in other environments, and the way in which traits are inherited, all allow for more accurate predictions of the genetic merits of every animal.
- **Optimal breeding plans** that strive to reach these goals. This is where breeders should decide which animals to cull and which breeding practices to follow. For example, decide how a male animal will qualify as a semen donor (or a female animal as embryo donor). The individual breeder usually has a choice of whether to breed the best with the best or whether to apply some other type of corrective breeding, or a combination of both.

These three aspects are interdependent. The impact of accurate breeding value predictions really has to do with a technique of placing animals in order of importance according to their genetic merit for a whole series of (economically) important traits. So, how does BLUP work and how is it possible to separate environmental factors from the genetic (heritable) part?

In order to explain this, we need to start with a very important equation in animal breeding, namely: P = G = E. In everyday language: Any measurement (observation or phenotype) is determined by the animal's genetic composition and the influence that the environment has on its manifestation. In the case of economically important traits, environmental influence is usually bigger than the genetic component.

4.1.2 Environmental factors

The relationship between the proportion that makes a difference in the genetic composition, compared to the environmental influence, is known as the heritability of the trait – in other words, which difference in measurement within a group of animals can be attributed to the heritable genetic differences between them.

This is only possible by limiting the environmental influence and comparing animals that were subjected to the same treatment. One example is calves or lambs born in the same season and on the same farm, kept together closely in an age and gender group, etc. In the past breeders would receive statistical adaptations – so-called indices compiled by performance testing schemes. However, as estimates of the genetic merits of animals these values do have certain limitations.

4.1.3 Index limitations

Firstly, it says nothing about the differences in heritability of the various traits. One is also not sure of the animal's value as a breeding parent, should his or her progeny perform well in another environment (another farm, season, production system, etc). There are also other factors that are not considered, such as gender limiting traits (milk production,

calving interval, maternal traits) or where a chosen animal's progeny doesn't perform as well as initially expected, despite an unchanged (good) index.

One may now also wonder whether a bull is genetically sound if his calves' average performance is better than the progeny of other bulls. This can only be true if all the bulls were put with cows randomly and no preferential breeding took place. The good performance of a bull's progeny can be the result of good mothers, as one would typically find with preferential breeding.

4.1.4 BLUP is born

These were some of the questions Charles Henderson (1912-1989) was struggling with at the Cornell University in the United States, when he came up with a brilliant solution. He combined various information sources in order to reconcile the predicted genetic merit of farm stock in the **B**est possible way with the true genetic merits of the same animals.

He then drafted a set of **L**inear equations for each animal, taking into consideration the factors that describe the differences in these animals' performance. These equations take into account a few important factors, namely differences due to measurements across contemporary groups, the heritability of the traits (how many of the differences are due to the genetically heritable portion) and, the biggest breakthrough, to what extent the relatives of an animal (i.e. his/her parents, half siblings, progeny, other siblings such as cousins, nephews, nieces, etc.) are performing within their contemporary groups, compared to the rest of the animals in these groups.

The principle is that related animals share identical genes (full sibling 50%, half sibling 25%, etc.). One can almost say that for every measurement of a family member, another aspect of the animal in question in another group (farm, season, year and even country) is compared to other animals. This new method is free of breeding preferences and is **U**nbiased in its **P**rediction of the genetic merits of farm animals. And thus, BLUP was born.

Henderson had a group of brilliant students who furthered his ideas after his death. Other scientists also picked up on these concepts and as a result, algorithms and methods were developed to enable computerised predictions and increased accuracy of BLUP values. One of the major challenges, namely to determine heritability and genetic correlations that could be used in the BLUP breeding values, are addressed especially in Robin Thompson's development of the so-called residual maximum likelihood (REML) method.

The BLUP sire model, Henderson's first attempt, was later expanded to the BLUP animal model and again to the BLUP multi-trait model. The latter addressed a major problem, namely the breeding practice where animals are gradually culled (sequential culling). This happens especially with beef cattle and other meat-producing species.

Other important developments were the inclusion of other genetic and non-genetic factors which contributed towards differences in measurements among animals within the same contemporary groups. Examples are the inclusion of genetic and non-genetic maternal effects.

All these developments assisted current users of BLUP to work with more reliable values; a tool enabling breeders and buyers of breeding animals to decide which animal will make a genetic difference to their herds, as their progeny will perform better than those of other animals.

4.1.5 Practical use of breeding values

It remains important for breeders to retain perspective. BLUP breeding values are

estimated for a wide series of traits ranging from simply measured objective traits (such as bodyweight or milk production), subjectively judged traits (such as linear traits of dairy cattle), laboratory results (such as butterfat, somatic cell counts, fibre density), complex derived traits (such as dressing percentage, feed efficiency) and composite monetary selection indices (actually a combination of BLUP breeding values, genetic correlations between traits and economic values of each, combined into one figure).

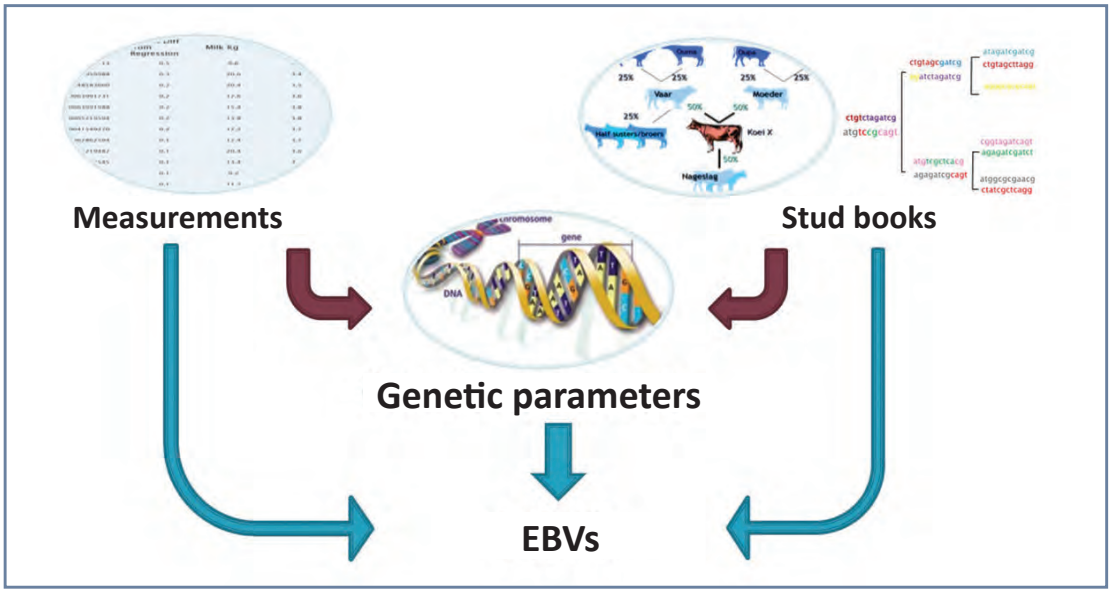
A combination of traits (or even a composition, such as selection index for something like cow profit) together with visual appraisal based on functional form, should form the basis of all decisions.

A breeding objective is the breeder's ultimate goal. Selection criteria are the traits the breeder must select for in order to achieve the breeding objective. In the case of fertility, the selection criteria are scrotal circumference, calving interval, and age at first calving. For maximum growth up to weaning age the selection criteria are weaning weight and milk production as measured by the BLUP breeding values for weaning direct and weaning maternal.

BLUP breeding values can be put to good use for corrective matings, either to correct shortcomings in the herd, such as low milk production, or to build on the herd's strong points. For every breeding objective, unique bulls with desirable breeding values for specific selection criteria can be identified by means of BLUP, something which is impossible through visual assessment alone. Admittedly, it is possible to make a choice based on the father and mother's performance. However, breeding values are a prediction of how the bull will breed and an indication of his progeny's performance.

Although an auction catalogue will contain breeding values for almost every measurable trait, there are three basic breeding values that should always be considered when selecting a bull. These are the breeding values for birth direct, wean direct, and wean maternal.

Figure 4.1: Estimation of genomic breeding values. (Source: SA Stud Book)



Practical application

- **Maximum growth:** Take note of high breeding values for birth direct and wean direct. There is a high correlation between birthweight and weaning weight, which means a calf that is big at birth should also be heavy at weaning. The bull's progeny will naturally all be destined for the feedlot and the bull will not be used to cover heifers. However, the breeder should be on the lookout for possible calving problems. This is referred to as a bull for terminal use.
- **Replacement heifers:** If possible, use the breed average for birth direct, and above the average for wean direct and wean maternal as a guideline when selecting. Wean maternal is also important because it is an indication of milk production and is important in the cow herd for heavy weaner calves. In this case, balanced breeding values are important to establish a good balance of economic traits in the cow herd.
- If a breeder is aware of shortcomings in his herd, e.g. low milk production, the logical choice would be to identify a bull that is strong in terms of wean maternal, but to not sacrifice the other traits entirely.
- If a breeder already has **good growth up to weaning age** in his herd (i.e. above-average weaning values for wean direct) but is trying to achieve further genetic improvement in the herd, he should always buy a bull with a better breeding value for wean direct than the previous herd bull.
- **Fertility** can be improved using the breeding values for calving rate and scrotal circumference. Scrotal circumference, for one, is an indication of the bull's fertility. Other information such as the intercalving period of the bull's mother is also valuable.

IMPORTANT POINTS TO REMEMBER

- Breeding values are always provided in the same unit as the measurement; in other words, if weaning weight is measured in kilogram, the breeding value is also given in kilogram.
- The criterion against which a breeding value should be measured to see whether it is good or poor is always the breed average for a specific trait, which is based on the live animals in the breed and also appears in the auction catalogue.
- Breeding values may be positive or negative, and for a trait such as birth direct a negative value may be 'better' than a positive one.
- Get hold of the auction catalogue well in advance and compile a shortlist of bulls that meet the desired breeding objectives. Then the breeder will not be intimidated by lots of data and numbers on the day of the auction, because he will already have a shortlist of possible bulls in mind and will only have to make a choice based on visual inspection.
- Remember, a handsome bull will not necessarily possess the desired breeding values. But of course a bull with the desired breeding values could also be handsome to look at.

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4.2 GENOMICS AND THE LIVESTOCK PRODUCER

Genomics can be described as the study of the complete DNA content of a cell within an organism. It is an aid to determine the genetic merit of young animals even before they have been measured. The accuracy with which their breeding values are predicted, have reached acceptable norms.

Most economically important traits are measurable. Some, however, are generation-limiting traits and others can only be measured later in the animal's life, while certain traits cannot be measured in live animals and others are too expensive to be measured.

It is precisely when these traits are at play, that genomic information becomes very useful. In this way the producer can gain a clear and accurate picture of the animal's value, by looking at ancestor performance. Most traits are carried over from one generation to the next and are captured in the genes.

4.2.1 Identifiable traits

- Traits found in one generation:
  - » Milk production.
  - » Fertility breeding values in heifers, cows and bulls.
- Traits that can only be measured later in the animal's life:
  - » Longevity and productive herd life.
  - » Calving interval.
  - » Milk production, especially in later lactations.
  - » Traits that can only be measured in bulls' daughters, such as selection of dairy breed bulls.
- Traits that cannot be measured in live animals:
  - » Carcass properties.
  - » Meat quality.
- Traits that are expensive or sometimes difficult to measure:
  - » Feed conversion and intake.
  - » Disease resistance.
  - » Carcass and meat quality.

4.2.2 Reference populations

The goal of genomics, as with BLUP values, is to measure animals of one breed with one another. In order to correctly use genomic information for genomic selection purposes, the genomic information of at least 1 000 animals from the same breed must be collected and their BLUP value prediction must be very accurate. This group's BLUP breeding values must be correlated with their genomic information.

A reference population is a group of bulls and cows representing a breed at genetic level. Several methods are used to create a reference population, but the fact remains that they are influential bulls and cows that have made a significant contribution to the breed through the performance of their progeny.

The reference population links actual genetic performance to a portion of the animals of the breed, making it possible to describe these animals according to genetic traits at genomic level. It serves as the benchmark against which all the animals in the breed that are genomically tested, can be described. The result may be that only blood or hair samples will be required in future to select animals for all traits of economic importance.

If the reference population consists of 5 000 to 6 000 animals, the genetic breeding value determined in this way for the different traits will be approximately 60% accurate. Information from many more animals is necessary for accurate breeding values, but it will depend on various aspects, such as the heritability of a trait.

Genomic breeding values for certain traits are determined by combining the use of genetic and performance data.

4.2.3 Genomics and the livestock producer

To remain competitive, beef cattle stud breeders and commercial producers have no option but to become involved in such projects. Genomics will play a significant role in identifying economically important traits such as milk production in beef cattle, the fertility of a bull's daughters, meat tenderness, feed efficiency, etc.

Now that genomic breeding values have become popular, one could easily think this means the end of measuring and weighing. Genomic selection, however, is based on precise relationships between animals and the connection accurate genetic merit has with the genome; in other words, the heredity base of animals in which the performance of their offspring is known. This performance can obviously only be known if livestock producers measure and record it.

The need for thorough and complete measurements and records is now more important than ever. The connection between performance and genomic information will be lost if it is not constantly updated and recalculated.

Of course, animals for which there aren't any measurements also benefit from the use of genomic information, but the system is not sustainable if measurements are simply discarded.

4.2.4 Beware of inbreeding

Genomic breeding values increase the accuracy with which the genetic merit of animals is predicted. As a result, the chances of the offspring performing as expected will be higher. Wrong choices, especially regarding bulls, will land one in trouble very quickly.

Good genes tend to run in families. If one looks only at the genetic merit of potential breeding animals without looking at relationships, inbreeding is likely to skyrocket. This has enormous disadvantages, notably in the form of lower survival, lower fertility, and loss of variation, which in turn limit future selection progress.

With or without genomic information, genetic merit prediction is one of three very important building blocks of selection and breeding. It all starts with proper breeding goals. Traits for which accurate breeding values are available are included and contribute proportionally due to their economic value, genetic relationship with other traits, and their breeding value variation.

A breeding programme that ensures optimal goal achievement will complete the picture. Such a programme ensures that the right bull is mated to the right cows, and that inbreeding doesn't increase disproportionately. In other words, the achievement of breeding goals remains a sustainable aspect of genetic change.

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4.3 ANIMAL RECORDING ON A LIVESTOCK FARM

Farm animals are measured for four very important reasons:

- To set fixed guidelines for production standards – what you can expect in a given set of environmental conditions or management situations (milk volume, weaning weights, calving regularity, wool weight, and reproduction rate).
- Production cycles and the use of strategic planning and marketing – cyclical changes in production, disease conditions, and reproduction rate.
- Interventions and adjustments in management practices at herd level, to ensure optimal sustainable production. How do groups of animals exposed to the same management practices, health measures, and feeding practices produce and how healthy are they compared to other groups?
- Use of breeding value predictions to make the best selection decisions.

4.3.1 Using data for management decisions

Any event warrants the recording of a minimum amount of data. At the same time, the events covering an entire period can be recorded as thoroughly and complete as possible.

A good example is when a weather forecaster predicts rain. If rain is predicted for the next day and it rains, even if only 0,2mm fell, then the weather forecast was 100% correct. If no rain fell, it was 100% wrong. The fact that only 0,2mm of rain fell usually does not mean much and is of very little value, but it does not matter because the forecast was spot on.

And here we aren't even talking about all the other variables such as thunder, wind, hail, cloudbursts, or type of precipitation. The list can become very long. As a result, there is a great need for more complete weather forecasts that can better address and predict the variables, and these improved forecasts are based on the amount of accurate data available to the forecaster.

4.3.2 Calving date as a data source

The same principle applies to the recording of beef cattle production data. The only thing that needs to be recorded is the calving date of a cow, as this is the most important notation. With this one date we can determine age at first calving (AFC), age (month) at which the female animal first became productive by producing a calf, and the intercalving period or ICP (the period between two consecutive calvings measured in days). However, limited data will provide only limited results.

It is therefore best to record as much data as possible. By recording breeding data such as 'date in' with the bull, the period the cow has been with the bull (breeding period) and whether artificial insemination (AI) has been used, a good 'rainfall' worth of information can be obtained. This data helps to determine how many opportunities there were for conception leading to that particular pregnancy and calving.

It will also help with identifying planned management actions to get the breeding herd through certain seasonal trends such as droughts, as well as the correct interpretation of female animals' true production capacity for reproduction, which is the biggest driver of economic efficiency in the beef or small-stock enterprise.

4.3.3 Additional weaning weight data

To record its weaning weight, the calf can be weighed on a day as close as possible to the age of seven months (≈ 205 days of age) or just before the day of sale. This will indicate to the producer how much the calf

Tabel 4.1: Weaning weight ratio data.

Calf weight (kg)	Cow weight (kg)	Weaning weight ratio (%)	Age of calf at weaning (days)
230	398	58%	205
230	455	51%	240
230	515	45%	205
230	455	51%	195
230	425	54%	180

(or cow as a production unit) is worth in rand value.

However, should the cow also be weighed on the same or the following day, three times more information can be obtained. *Table 4.1* indicates the value of the weaning weight ratio as an additional selection tool.

The weaning weight ratio is the calf's weaning weight (directly weighed or age-corrected) as a percentage of the cow's weight on the day of weighing and/or weaning. The weight of the weaned calf must be at least 45% of the bodyweight of the cow. If the cow fails to deliver in this regard, she is inefficient, even if she has produced a calf every year.

Weighing the calf and the cow together means the producer can calculate the calf's potential income, as well as identify superior heifer calves that can be included as potential replacement animals in the herd. Cows' efficiency in respect of weaning weight ratio can also be determined in this manner. The weight of the breeding cows is also known, given that they must be pregnant for another six months and must be in the right condition before the next calving in order to maintain optimal production.

4.3.4 Putting weight data to use

Using data correctly to make the best decision possible is a principle that is equally applicable to small stock. The weaning weight of lambs should be determined when they are between 60 and 150 days of age. The total weaning weight of a ewe that was able to raise multiple lambs up to and including weaning may be more than the total weight of a ewe that raised only a single lamb. Therefore, including the ewes in the weighing process will assist in identifying the most efficient ewes.

This may be a more challenging endeavour in larger, extensively farmed small-stock flocks but if the producer wants to be compensated fully for his or her time and production inputs, accurate weighing of both the breeding animal and her offspring provides the best data for decision-making.

Heifers should be weighed post-weaning at 12 and 18 months of age – this data will indicate whether the animals have grown sufficiently to reach their target weight at first mating. As a rule, heifers should weigh 65% of their mature cow weight at first mating. The weight of the cows must also be recorded, so it is best to include them in the weighing process when their offspring are weighed at weaning.

This is the other benefit of using additional information based on a single weighing incident – two herds of the same breed located 30km from one another, can exhibit a significant difference in mature cow weight (and therefore also the 65% goal for heifers).

Small stock are weighed between the ages of 151 and 380 days for post-weaning weight, and between 320 and 540 days for mature weight. All weaned animals

that have not been marketed should be weighed for post-weaning weight at approximately 250 days of age; this also applies to the retained animals once they have reached their mature weight. The weighing of both groups of animals assists in identifying seasonal growth curves and monitoring of animals to make sure they grow as they should.

Producers making use of an eight-month system (three lambings per ewe over 24 months) will weigh their animals at as young an age as possible. Extensively farmed flocks will utilise seasonal effects to determine weighing dates, within the age limits applicable to that phase.

All animals – beef cattle and small stock – must be weighed, regardless of seasonal influences. Weighing often singles out animals that are efficient even when the season is not at its best. Weigh all animals as and when necessary and let the data indicate which animals are worth their salt and which are lagging – not the other way around. An accurate scale will not benefit or harm any animal. It is an animal's own performance that makes it either a winner or cull animal.

4.3.5 Importance of birthweight

In some cases, data can be like 'thunder with a chance of hail' if it is not measured accurately. A good example is the calf's birthweight. *Table 4.2* illustrates the effect of birthweight ratio (BWR).

Birthweight ratio is the calf's measured birthweight as a percentage of the cow's weight at calving. The calf must be weighed within three days of birth to record an accurate birthweight. The cow must be weighed within seven days of having calved.

Table 4.2: Birthweight ratio.

Birthweight of calf (kg)	Weight of cow at calving (kg)	Birthweight ratio (%)
38	398	9,55
38	455	8,35
38	515	7,38
38	700	5,43

The less the calf's BWR as a percentage of the cow's weight, the 'lighter' the calf will be relative to other calves with the same birthweight. Larger cows can easily deliver calves that have higher direct birthweights. However, that assumption demands careful consideration. A higher birthweight and recorded BWR provides clear information, but an unknown BWR makes for 50/50 guesswork.

Weigh the cow as soon as possible after weaning – it will be worth the effort to prevent 'thunder with a chance of hail'. It is also possible to determine the BWR of small stock, but this really only applies to breeders who make use of lambing pens.

4.3.6 Post-weaning evaluations in beef cattle

Stud breeders are also faced with the challenges associated with the post-weaning evaluation of production animals, especially male animals earmarked as future breeding stock.

Many producers who breed beef cattle believe that a bull must be evaluated in the environment in which he needs to perform. A young bull is therefore tested for growth while on the veld, seeing as he will be required to do his work on the veld during the breeding season. Eventually, however, that bull's progeny will also have to show what they are capable of in a feedlot-type environment.

In a commercial farming environment, it is likely that up to 30% of the bull's heifers and all his bull calves will be sold to a feedlot or finished on the farm by the producer. Testing the growth potential of young bull calves under both intensive and extensive conditions is therefore essential.

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Table 4.3: Random allocation of male progeny post-weaning.

Type of growth test	Breeding bull 1	Breeding bull 2	Breeding bull 3	Breeding bull 4
Intensive (feedlot nutrition)	Calf 1 Calf 5	Calf 1 Calf 5	Calf 1	Calf 1
Semi-intensive (growth ration)	Calf 2 Calf 6	Calf 2 Calf 6	Calf 2 Calf 5	Calf 2
Semi-extensive (cultivated pastures or pasture/ background nutrition combination)	Calf 3	Calf 3	Calf 3 Calf 7	Calf 3
Extensive (veld/lick combination)	Calf 4	Calf 4 Calf 8	Calf 4 Calf 6	

By making use of the Latin square of random allocation, all male progeny retained by the stud breeder can be allocated post weaning (*Table 4.3*). The progeny of each breeding bull is subjected to a certain type of post weaning growth test.

Using breed standards or functional efficiency errors to identify cull animals at weaning, the breeder can easily place those bull calves in an intensive feedlot-type setup for testing in a bid to generate feedlot data. The remaining calves can then be randomly assigned to the other phases of testing. This type of testing does, however, have a higher price tag and requires more intensive management.

4.3.7 Benefits of monthly weighing

Breeders should strongly consider employing the management practice of weighing all animals on a monthly basis. Monthly weighing offers the following benefits:

- Monthly herd inventory and head count.
- Easy adjustment of nutrition and management actions, such as putting out or changing licks, shortly after weighing the animals. Its effect can be measured soon after.
- During each weighing or critical production period, animals' condition can be measured, allowing for swift management action where necessary.
- Weighing and vaccination can be done simultaneously. It also simplifies the process of vaccinating heifers within the correct window period against brucellosis and other seasonal diseases that require immunisation.
- Finally, all animals can be accurately weighed and evaluated.

Some breeders choose to only record calving dates, the weaning weight of the calf, and heifer weights shortly before the breeding season commences. It is like predicting 'rain for the following day'. Such a statement contains just enough information to be 100% accurate, but it does not clarify how much precipitation, whether 0,2 or 22mm, is to be expected.

Frequent weighing, on the other hand, will provide the producer or breeder with more information which he or she can then interpret to timeously identify aspects that can cause 'thunderstorms'. This allows for superior animals to be identified which will ultimately maintain or improve herd production.

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4.4 HOW HYBRID VIGOUR CAN BENEFIT BEEF CATTLE PRODUCERS

One of the most powerful tools a commercial beef cattle producer can use to improve the productivity and efficiency of his herd is a well-thought-out crossbreeding programme that takes advantage of heterosis (hybrid vigour) to capture the favourable characteristics of each parent breed in the offspring.

The highest level of hybrid vigour is obtained when crossing the most diverse breeds and selecting the parent stock according to the production system and environment.

4.4.1 Crossbreeding for commercial markets

Stud breeders use the latest research information and technology to genetically improve their herds and stay ahead of the competition. Their main market for breeding animals is commercial cattle producers. Crossbreeding the right bulls puts economically important traits such as growth, carcass traits, feed efficiency and maternal traits within easy reach of the commercial cattle producer.

Crossbreeding is essentially the opposite of inbreeding and involves the mating of unrelated animals. The less related the parents, the greater the effect of crossbreeding in the offspring. Normally, parents of different breeds are less related to each other than parents of the same breed. This means genetically distant breeds are likely to produce offspring with greater hybrid vigour.

The overall increase in performance is due to the offspring born from such matings being more genetically diverse. The effect is known as heterosis, or hybrid vigour. Normally, the greatest benefit of hybrid vigour is seen in traits with low heritability. It is also these traits that are most harmed by inbreeding.

4.4.2 Maternal and hybrid vigour

Carefully planned crossbreeding programmes utilise two specific forms of heterosis, namely maternal and direct hybrid vigour. Maternal hybrid vigour harnesses the advantage offered by the crossbred dams, such as fertility, easy calving, excellent maternal traits and adaptation to the environment or production system.

Direct hybrid vigour takes advantage of growth rate, feed conversion efficiency, and carcass traits. These advantages are not always due to hybrid vigour, but also because of breed complementarity. The desired characteristics of the different breeds are therefore utilised in their offspring.

The late Dr Michael Bradfield of the Livestock Registering Federation (LRF) said more than 5% inbreeding in a herd is senseless, as it emphasises weak traits which can be detrimental to the profitability of a livestock farming enterprise. In contrast, crossbreeding offers hybrid vigour which can increase the profitability of the herd by up to 23% while boosting all the economically important traits.

4.4.3 Genetic diversity

Some livestock producers aim to breed animals with a uniform appearance without preserving the genetic variation between animals, thus hampering genetic progress. Genetic progress combines the superiority of an animal is in terms of economically important traits, the level of heritability of these traits, and the genetic variation in the herd.

Genetic variation encompasses the genetic and phenotypic differences between the best and worst contemporaries

in the herd in terms of, among other things, fertility, growth, and carcass traits. Livestock producers often struggle with this contradiction of wanting to breed uniform animals while trying to genetically improve their herds.

Crossbreeding promotes genetic diversity in the herd through the variation that exists within each of the breeds in the crossbreeding system, as well as the variation between breeds. If selection pressure is applied in a breed to compensate for a deficiency in another breed, the desired genes are present at a higher frequency as opposed to the genes observed when only one breed is mated.

Research conducted at the Beef Cattle Research Center (BCRC) in America shows that crossbred cows generate 23% more money annually, have a 15% better life expectancy, and their lifetime production increases by 30% compared to purebred cows.

Several scientifically based studies confirm that it is possible to significantly improve beef cattle production by using crossbreeding systems. Unfortunately, these studies also indicate that crossbreeding programmes are often poorly planned and not optimally managed, leading to the hybridisation of cattle breeds and the benefits of hybrid vigour being lost.

4.4.4 Significance of purebred bulls

Purebred bulls are essential for a successful crossbreeding programme. However, this system is not without complications as it requires a high level of management skills, good infrastructure, and the continuous supply of purebred breeding material.

Although bulls only make up about 3 to 4% of the animals in a breeding herd, they do contribute 50% of the traits of each calf. A total of 87% of a calf's genetic composition is determined by the bulls used in the herd over the last three generations. Up to 90% of the genetic progress in a herd is achieved through good bull selection.

The fact that purebred bulls certainly increase the performance of a beef cattle herd is reflected in the results of a trial in which the average weight of the weaned calves of three purebred breeds was 186kg at 205 days of age. Where purebred cows were crossed with bulls from some of the other breeds, the F1 calves weighed an average of 200kg. Where purebred bulls were used on F1 cows from these crosses, the weaned calves weighed an average of 208kg. However, the same progress is lacking when using crossbred bulls on purebred or crossbred cows.

4.4.5 Typical crossbreeding systems

Crossbreeding systems can be divided into two categories, namely a system that produces its own female replacement animals (a rotation as well as a combination of rotation and terminal system) and one that produces only terminal crossbred calves.

Since replacement heifers are retained in a rotation system, one should preferably select bulls with good maternal, growth, and carcass traits. For a terminal system, the focus is on selecting bulls for their growth, and carcass traits, as replacement heifers are bought in.

4.4.6 Rotation systems

The two-breed rotation system comprises two groups of cows. Group 1 includes cows from breed A that are bred to bulls from breed B. The second group of cows comprises female animals from breed B that are bred to bulls from breed A. After a series of alternate back-and-forth crosses, around two-thirds of the breeding material comes from the last bull utilised from the breed, while the other third comes from the other breed.

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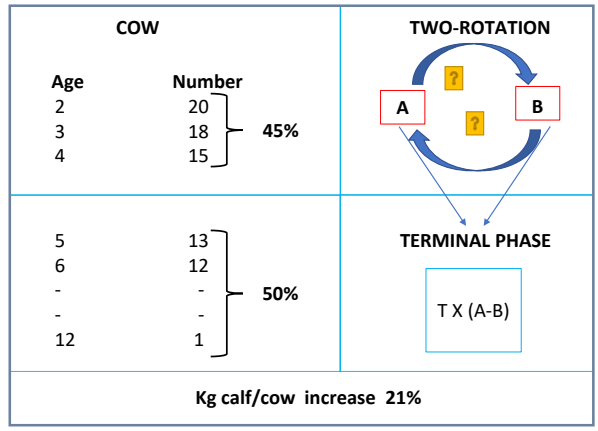
The three-breed rotation system works much in the same way as a two-breed system, except for the introduction of a third breed. If the system is properly managed, almost 86% of the potential heterosis can be retained. As more breeds are introduced into the system, the retained heterosis increases.

Breeds with a diverse genetic profile can cause calving problems and greater variation, leading to problems relating to the feeding and marketing of calves.

Figure 4.2: Example of a rotation-terminal crossbreeding system.



4.4.7 Composite or synthetic breeds

A synthetic breed is composed of two or more different breeds and is tailored to take advantage of hybrid power. This is achieved without having to engage in crossbreeding. Synthetic breeds usually incorporate a combination of breeds, each with a sought-after trait in respect of performance and/or adaptability.

Managing a composite breed is relatively simple, as its management is similar to that of a purebred breed. A certain level of heterosis can be maintained within a synthetic breed, as long as there are enough unrelated sires that can be utilised in each generation to prevent inbreeding. The greatest disadvantage of synthetic breeds is the loss of heterosis over time due to inbreeding, as the animals are bred from a smaller gene pool.

4.4.8 Terminal system

A terminal crossbreeding system follows a specific pattern in which a particular bull breed is bred to a pure- or crossbred cow, and all progeny is sold. Replacement heifers are bought in. As far as the paternal line is concerned, aspects such as high growth potential and good carcass traits are highly valued.

The benefits of heterosis are fully utilised when a crossbred cow (F1) is bred to a sire from a third breed. In this system female animals are selected based on their ability to adapt to the environment and resources, while selection for male animals is based on product targets such as growth and carcass traits. One of the biggest challenges in this system is finding a sustainable source of high-quality replacement heifers.

4.4.9 Rotation terminal

Rotational-terminal systems combine the best elements of the traditional rotation and static terminal systems. Replacement heifers are obtained from the rotational portion of the system, while the terminal portion allows fast-growing bulls to produce most of the marketable calves. *Figure 4.2* illustrates a representation of such a system.

Cows are kept in the rotational portion of the system until they are four years old, after which they are moved to the terminal portion of the system and all calves are marketed. The main disadvantage of this system is that a large herd of at least 100 cows is needed and that it requires intensive management.

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4.5 REPRODUCTION TECHNOLOGY

4.5.1 Artificial insemination

Artificial insemination (AI) was the first major biotechnology to appreciably improve reproduction in farm animals. It is defined as the technique of transferring semen collected from a superior male animal into the reproductive tract of a female animal.

Artificial insemination is widely used for livestock breeding worldwide and is a crucial tool for sustainable farm animal breeding. The AI technique is advantageous to many livestock producers as it allows for a shorter calving season, thereby producing a more consistent and uniform calf crop. However, effective heat detection and timely AI practices are important for livestock producers who apply AI. Since a bull is not necessarily required for an AI operation, many sexually transmitted diseases are greatly reduced or eliminated.

The success of AI depends largely on the proper detection of oestrus and skilful insemination. It is crucial to the success of AI to stick to the rule referred to as the 'a.m. to p.m. and p.m. to a.m. system', based on heat observation, palpation of the ovaries and breeding records.

Briefly, female animals first seen to be in oestrus in the morning should be inseminated during the afternoon of the same day. Female animals first seen to be in oestrus in the afternoon should be

AI TECHNOLOGY, LIKE ANY OTHER AREA OF ANIMAL BIOTECHNOLOGY, HAS ADVANTAGES AND DISADVANTAGES:

Advantages

- ☺ It minimises the risk of spreading disease between animals.
- ☺ Using the semen of superior male animals greatly enhances genetic improvement.
- ☺ Thousands of female animals can be inseminated annually with the semen from a superior male animal, which is not the case if animals mate naturally.
- ☺ Considering the quality of the male animal used for AI, there is no comparison between the cost of buying the male animal and the price of semen.
- ☺ Sires with superior and proven genetic traits can be identified.
- ☺ Frozen semen may be distributed to any part of the country, making it possible to overcome geographical distances between male and female animals.
- ☺ It is economically advantageous not to have to pay for the feed and management of a male animal.

Disadvantages

- ☹ Management skills are required to implement an AI programme effectively.
- ☹ Good facilities and nutritional resources are required to handle a large number of cattle.
- ☹ Additional costs associated with AI include the labour required for oestrus detection, the cost of employing well-trained and technically skilled personnel, and the cost of the hormones required for oestrus synchronisation.

inseminated before noon the next day. The optimum time to inseminate in order for fertilisation to occur is 12 hours after standing heat.

4.5.2 Embryo flushes

With conventional embryo flushes and transfers (multiple ovulation embryo transfer – MOET) the donor cow is stimulated by injecting external hormones (Folltropin) over a period of four-and-a-half days. The donor usually comes into heat six days after the initiation of superovulation and is inseminated at 12-hourly intervals with two straws of semen. Six straws of semen are usually used per donor cow.

Seven days later, the embryos are washed out of the uterus with a three-way catheter. The embryos are picked out under the microscope, graded, and washed. The embryos are then placed in a holding medium until they are frozen or transferred to recipient cows which have

ADVANTAGES OF MOET

- ☺ More calves are obtained from genetically superior cows.
- ☺ More marketing opportunities are unlocked through the sale of progeny or embryos.
- ☺ More calves are conceived from very scarce and valuable semen.
- ☺ Higher progeny numbers can help to determine the genetic merits of donor animals at a very early age.

DISADVANTAGES OF MOET

- ☹ High cost of embryo programmes.
- ☹ Intensive management is required.
- ☹ Not all donors respond to superovulation – low repeatability.
- ☹ Conformation changes can occur in donor cows.
- ☹ Reproduction disturbances can occur.

AI in sheep

The most effective sheep AI method is the laparoscopic (surgical) procedure, but this is expensive and requires a trained technician. A laparoscope is a rigid fibre-optic telescope that is passed through the abdominal wall and allows the technician to locate the internal reproductive tract and inject the semen into the lumen of the uterine horn. There are alternative methods such as cervical and vaginal insemination that are inexpensive but fertility is generally low because the cervix is not readily penetrated. Consequently, the semen is rarely deposited in the uterus. An essential step in the AI programme is the successful synchronisation of the ewes prior to AI, which is crucial for delivering the necessary ova to the site of fertilisation at a specific time.

AI in cattle

The recto-vaginal technique is the most commonly used technique for the artificial insemination of cows. To date, there are numerous timed AI protocols. However, there are several factors that affect the successful implementation of AI, such as failure to detect oestrus early in the breeding season or improper timing of AI owing to heat detection faults, which may result in extended calving intervals. For the successful implementation of AI technology, livestock producers should be skilled in heat detection and keep proper records of fertility and reproduction in the herd.

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been synchronised with the donor cow. A pregnancy examination is carried out 60 days after the transfer.

With MOET, a donor can be flushed every 60 days. An average of six to eight embryos can be expected with each flush. Eighteen pregnancies a year and a conception figure of 50% is possible.

4.5.3 *In vitro* embryo production (IVEP)

IVEP consists of three stages:

1. Oocyte pickup (OPU).
2. Production of embryos in the laboratory (IVEP).
3. Transfer of embryos.

Oocyte pickup is carried out by harvesting oocytes (egg cells) directly from the ovaries. A long, thin needle is fed through the vaginal wall under ultrasound guidance and the follicles (containing the oocytes before ovulation) on the outer wall of the ovaries are extracted by vacuum suction.

The oocytes are then picked out, selected and immediately placed in a mobile incubator in a special maturation medium to reach the laboratory within 20 hours.

Embryo production in the laboratory takes place in incubators which imitate the womb and can be divided into five stages:

- Maturation of the oocytes.
- Fertilisation of the oocytes.
- Cultivation of the embryos.
- Nourishment of the embryos.
- Evaluation of the embryos.

Embryos that have been successfully grown are then transferred to carrier animals or frozen (vitrified). The freezing technique used with IVP embryos (*in vitro* produced embryos) differs from IVD (conventional) embryos in that IVP embryos are vitrified. Vitrification is a very rapid freezing technique. The embryos are exposed to a freezing medium for 80 seconds and immersed in liquid nitrogen immediately afterwards. Special mediums are required for thawing the embryos afterwards.

Transfer of embryos takes place eight days after ovum collection or seven days after fertilisation of the oocytes. Final evaluation of the embryos takes place on the day of transfer. They are then placed in a special medium and transported to the transfer site in a mobile incubator. After evaluation of the recipient animal the embryos are placed in the womb. The process is exactly the same as with conventional (IVD) embryo transfers.

Before transfer the recipient animal is examined by an embryo veterinarian to determine whether she is suitable for receiving an embryo. The transfer of embryos involves loading an embryo in a 0,25ml straw which is placed in an embryo pistolet. The embryo is carefully sucked up under a microscope with the aid of a 1ml syringe.

The transfer is carefully carried out under an epidural anaesthetic. The vaginal area is cleaned and opened by an assistant so that the veterinarian can feed the pistolet up to the cervix.

The pistolet is carefully manipulated through the cervix and the embryo is deposited in the front third of the uterine horn. It is important not to damage the inner wall of the uterus, since this would drastically affect the chances of a successful pregnancy.

4.5.3.1 Benefits of IVEP

- Better utilisation of the genetic potential of top breeding animals – new herds can be built up from the best breeding animals without interfering with the calving interval of the recipient herd or the donor cows.
- No hormone treatment is applied.
- Donor cows do not undergo conformation changes such as overdeveloped withers and prominent tail roots.
- The collection of oocytes can start one month after calving.
- Oocytes can be collected from the donor up to the 3,5-month stage of pregnancy without affecting the foetus.
- More calves can be obtained during the life of the cow.
- Older cows with proven records can be used as donors.
- Semen costs are very low – as little as one straw can be used to fertilise the oocytes of six to eight cows (up 200 oocytes).
- It is cost-effective.

4.5.3.2 Facilities required

Because the oocytes are very sensitive to environmental factors, it is necessary to work in suitable facilities. A small room close to the crush can be equipped as a laboratory where the oocytes can be selected and processed. This room must meet the following requirements:

- It must be dustproof and free from chemical and other harmful fumes.
- It must be possible to control the temperature.
- It must have a suitable work surface that can be sterilised.
- It must have running hot and cold water.
- There must be power.

Good cattle-handling facilities are also essential. The OPU technique is very delicate and any unnecessary movement during the collection of the oocytes can influence the results. The crush where OPU is carried out should therefore preferably meet the following requirements:

- It should be sturdy with a proper head bail and rump bar.
- It should provide shelter against wind, sun and rain – preferably indoors.
- There should be alleys or gates behind the donor animals to allow people to work on both sides.

4.5.4 Pregnancy examinations

Reproduction technology such as pregnancy examinations is a tool which is capable not only of helping the small-stock breeder and commercial producer to improve the next lamb crop but also of improving the whole flock over time.

Ultrasonic scanning is a technology that helps identify management risks in places that cannot be seen by the producer. And when you can define a risk, you can manage it. Ultrasonic scanning is an internal examination carried out with the aid of an ultrasonic scanning apparatus, which 'looks' in places where one cannot see and cannot get the full picture by feeling. The apparatus emits ultrasonic sound waves, which are reflected by matter of varying densities and bounced back against the head of the apparatus. The computer then forms a picture of the various densities and shows it on a screen.

Stud breeders make use of this type of scanning and in addition there are many commercial producers who use it. One of the biggest advantages of ultrasonic scanning is that it gives the producer the opportunity to adapt his flock management in such a way that by weaning time he will have more and heavier lambs to market.

4.5.4.1 Costs

Many livestock producers will be quick to say that a veterinarian's services don't

come cheap and the use of technology such as ultrasound scanning is an unnecessary expense.

On the other hand, producers who do use this technology have already done the math and know that they gain a lot financially by managing it correctly. Apart from the fact that scanning can increase the profit margin of the farm, it can also save the producer time by making the management of the flock easier.

It does not take long to scan a flock. Under normal conditions a veterinarian can scan anything from 120 to 240 ewes per hour. The rate at which he is able to scan naturally depends on a few factors. These include the size and weight of the ewes, the speed of the handlers and their sheep-handling skills, and the stage of pregnancy of the ewes.

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5 FEED AND GRAZING

5.1 NUTRITIONAL REQUIREMENTS AND PRODUCTION STAGES

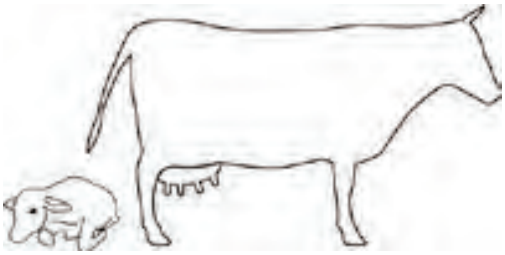
Meeting the nutritional requirements of livestock is very important for maintaining acceptable performance in newborn, growing, finishing, and breeding animals. From a practical point of view, an optimal feeding programme should ensure adequate intake of amino acids (both essential and non-essential according to traditional classification), carbohydrates, fatty acids, minerals and vitamins through a supplementation programme that corrects deficiencies in basal diets (e.g. milk replacers for calves and lambs, and available pasture for ruminants).

In addition, supplementing the diet with certain nutrients can regulate gene expression and important metabolic pathways to improve fertility, pregnancy outcomes, immune function, neonatal survival and growth, feed efficiency, and meat quality.

Broadly speaking, a proper balance of protein, energy, vitamins and all minerals of nutritional importance is necessary in livestock diets for a successful feeding programme that is both productive and economical. A successful feed programme must take an animal's production stages into account (in the case of, for example, a beef cow).

A PRACTICAL EXPLANATION OF COWS DURING THE FOUR DIFFERENT

Twelve-month production cycle for cows



Period 1: Calving and preparation for breeding

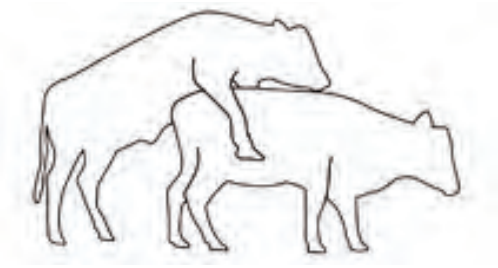
Their reproductive tracts must return to normal and the cows must come into heat again to rebreed after three months. Cows must also reach peak milk production to support calf growth. This is the most important nutritional period for the beef cow.

Cows must be supplemented with stored feed (such as hay) after calving if sufficient grazing is not available.

Provide trace minerals before the start of the breeding season.

The nutritional requirements of a cow during peak milk production, especially the daily amount of protein needed, are double that required by a dry cow.

1-1,5kg of protein per day.



Period 2: Breeding and pre-weaning growth of calves

A bull will mate with cows showing standing heat; cows should therefore gain weight during the breeding period. The best grazing possible must be available at the start of the breeding season. Cows will be in the early stages of the next pregnancy while producing milk for their calves.

Phosphate can be supplemented during the breeding season for optimal weight gain during breeding.

Most cows (>90%) in the herd should have a body condition score (BCS) of 2,5 at the start of the mating season and improve during this period.

BCS 2,5: The eye muscle is half full and the ends of the spinous processes feel well rounded.

SOURCE

- A practical explanation of the nutritional needs of cows during the four different stages of production. *Livestock Production Manual*. 2017.

THE NUTRITIONAL NEEDS OF STAGES OF PRODUCTION

calving at the start of the wet season

Period 3: Weaning of calves and pregnancy diagnosis

Up until weaning, they will start losing weight due to the declining nutritional value of the grass. Low levels of protein supplementation can be given as soon as the cows begin to lose condition. If a cow's condition score falls below 2,5, her calf must be weaned.

Provide high levels of protein supplementation from the beginning of the dry season so that a high intake of dry grass is maintained.

The nutritional needs of the dry cow are much lower after weaning but the digestibility of the grass also decreases drastically at the start of the dry season.

0,5–0,6kg of protein needed per day.

Period 4: Dry cow management and preparation for calving

The dry cow must now build up fat reserves before calving. In addition, 70 to 80% of the total foetal growth occurs during this period. This is the second most important nutritional period during the beef cow's production year.

Continue providing a high level of protein supplementation. Cows whose condition score is low (<3) must receive an additional energy supplement. Provide trace minerals and vitamin A, 30 to 60 days before the start of calving.

Most cows (>90%) in the herd should have a condition score of 3 or more, 30 days before the first calves are born.

BCS 3: The eye muscle is full and the spinous processes can only be felt if pressure is applied.

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5.2 VELD MANAGEMENT

Grazing research has clearly shown that the profitability of livestock production can be significantly improved over the long term by applying the right management practices focussed on veld improvement. Veld is and remains the cheapest source of animal feed and must therefore be protected, conserved, and used sustainably at all costs.

Overstocking, continuous grazing, too long grazing periods, repeated grazing at the same time each year, livestock breeds or game species that are not adapted to the veld type, as well as the long-term and indiscriminate use of licks and supplementary feeding, can be regarded as the most significant harmful practices. Therefore, sustainable veld and animal production must be based on observation, knowledge and monitoring.

5.2.1 A veld management system

Although there is broad consensus regarding the principles of veld management, role-players such as researchers, extension workers, and producers tend to differ regarding the relative merits of each veld management system in terms of satisfying these principles. A veld management system is a combination of rest and grazing periods into which the principles and objectives of veld and livestock management are built in.

Uncertainty regarding the success or failure of a particular pasture management system stems from the fact that at the start, as well as periodically thereafter, those involved did not carry out veld condition surveys to determine sufficient and objective changes in grazing trends.

It often happens that certain systems which propagate an increase in grazing capacity, and which develop and are recommended during wet cycles, then fail again during the first drought. It is very important to note that a long-term increase in grazing capacity is linked to an improvement in veld condition and that a grazing system is merely an aid to ensuring veld improvement.

5.2.2 Effective utilisation

Correct utilisation (intensity, frequency, and season) is the greatest challenge for successful grazing management. To be sustainable, this must of course be accompanied by long-term veld improvement or maintenance. The stocking rate must match the grazing capacity of the farm as closely as possible. This is not only linked to the environment (soil and climate), but veld condition also plays a major role.

While the correct stocking rate is certainly the most important component, decisions such as when to move animals from one camp to another are just as important for efficient utilisation of the grazing ecosystem.

How long livestock can normally graze a camp without harming the veld condition of course depends on numerous factors, including the season, type of livestock, as well as the camp and herd size. If livestock stay in a camp for longer than five months during the growing season, it will lead to selective grazing during which palatable plants will be harmed as a result of repeated defoliation.

In this case, it is sometimes better to extend the grazing periods in order to effectively extend the rest periods. Another sound grazing management principle is to vary the intensity of defoliation over different years.

5.2.3 Grazing management goals

- Long-term improvement of veld condition, which will lead to an increase in grazing capacity and animal production. One of the methods to quantify this goal is objective veld condition assessments over the long term.
- Making provision for drought by building in long veld rest periods (approximately every third year). Many grazing systems have failed in the past because it was believed that a camp could be repeatedly grazed again if the veld had rested while it did not necessarily recover. Recovery is regarded as an increase in the growth vigour of the plants due to a well-developed root system. A full growing season's rest provides an opportunity for the plants to regain their growth vigour and therefore not only rest, but also recover, thus increasing their drought resistance.
- The growth vigour of palatable plants should be higher than that of unpalatable plants. It serves as an early warning that the veld condition is about to deteriorate and can be easily observed during long rest periods.
- Lick intakes should be reduced over time. One of the first indications of a problem in a grazing system is when animals' lick intake increases.

5.2.4 Aspects affecting effective veld utilisation

- **Veld condition**, which determines the palatability, quality, and grazing capacity of the veld. It is very important to realise that the poorer the condition of the veld, the lower its ability to sustain animal production and the higher the risk of drought.
- **Farm planning**, which includes the number and size of camps as well as water supply. A minimum of three camps per herd will allow for effective pasture management, but normally more camps are required.
- **An adapted stock type** that will get as much of its nutritional requirements as possible from the veld and therefore require as little lick as possible, thus limiting long-term veld deterioration due to imbalances in the soil.
- **A number of management decisions** that include synchronising herd management with the normal seasonal variations of nature, as well as strategic financial decisions.

Since these factors are closely related, any combination of them can drastically influence the success of the grazing system used. Therefore, successful grazing management is only possible if the producer approaches the aforementioned factors in a holistic manner.

5.2.5 Success stories

One of the main reasons why not all producers find veld management systems appealing, is because they are not prepared to follow a long-term approach and expect immediate results in the form of financial return. *Table 5.1* summarises the impact of a few grazing management approaches in both sweet- and sourveld, where objective grazing evaluations were carried out.

Tabel 5.1: Impact of veld improvement using different scientifically based grazing management approaches.

Veld type, farm and owner	Impact	Management approach
Kalahari dune veld • Destinatum H Joubert *(Drs L du Pisani, H Fouché and M van der Westhuizen, as well as P Avenant and K Marais)*	**Over 14 years:** Improvement in veld condition of 32%; grazing capacity (GC) from 31 to 20ha/LSU in an average rain season; animal production increase of 55%. Changed from one of the worst to one of the best farms in the vicinity.	GC adapted based on veld condition and seasonal rainfall. At least six camps per herd. A growing season's worth of rest (from mid-winter to mid-winter following year) every third to fifth year, meaning 20 to 33% of camps rest every year. After a growing season's rest, camps are used for lambing/calving. In the season following a growing season's rest, camps are grazed at twice their grazing days. Camps are utilised three times per growing season, with sufficient rest between utilisations.
Transitional area: Kalahari dune veld to Molopo thornveld Vastrap • K Marais *(Drs L du Pisani, H Fouché and M van der Westhuizen, as well as P Avenant)*	**Over nine years:** Improvement in veld condition of 26%, GC from 24 to 17ha/LSU in average rain season; animal production increase of 40%.	
Southwestern Karoo-type veld Grootzuurfontein • A Griesel *(Dr M van der Westhuizen and G van der Walt)*	Bitterbos dominant veld is reclaimed, veld condition improves by 20% **over eight years**.	Three-group camp approach in which a group of camps are utilised for three months and rested for six months. GC adapted in accordance with veld condition and seasonal rainfall.
Sandveld of the Western Free State • Olive Hill • K Marais *(Drs M van der Westhuizen and H Fouché)*	**Over four years:** Veld condition improved by 5%; farm's GC 29% better than departmental norm.	Eight to nine camps per herd. Veld grazed short within a month and/or even two months; thereafter rested for a long time to improve growth vigour.
Red grassveld of the central Free State • Glen Agricultural Institute *(Drs Mias van der Westhuizen and J Erasmus, as well as P Goosen)*	In certain camps veld condition improved by 35%; GC increased by 72% from 9,1 to 5,3 ha/LSU **over eight years**.	Grazing period of one to four months, rest period of one to 11 months (average of six months), depending on physiological stage of cattle and veld; minimum lick supplementation.
***Elionorus* sour grassveld, Southeastern Free State Camelot • A Fouché** *(Dr Mias van der Westhuizen and P Goosen)*	Veld condition increased by 17%. GC increased by 33% from 6,1 to 4,6 ha/LSU **over 11 years**.	The growth vigour of selectively utilised veld was regained after one growing season's rest.

SOURCE
- Van der Westhuizen M, Snyman H, en Fouché H. 2013. Weiveldbestuur vir volhoubare diereproduksie.

5.3 BASIC GRAZING CALENDAR

Rainfall lies at the heart of all grazing production. In most parts of our country, the average rainy season generally lasts about four months (December to March). This is the time when grass is produced that our animals need as feed throughout the year. Overutilisation of veld or poor planning during the rainy season can have serious economic consequences. This problem can be mitigated by applying basic veld management practices.

5.3.1 Principles

Good grazing management revolves around three basic principles. If these requirements can be met, any grazing

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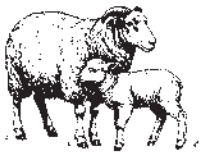

Colostrum Quality

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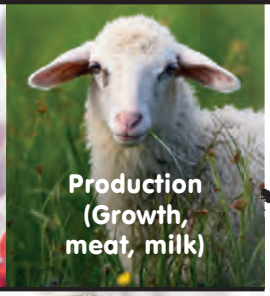

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management system can be employed. Different veld types on the farm must be utilised separately. Selective grazing will occur where veld is not separated.

A **Stay within the farm's carrying capacity limits.** All growth curves are S-shaped – a period of slow growth followed by a period of rapid growth, with a plateau afterwards. In the case of veld, this suggests a maximum production capacity per hectare, regardless of rainfall or other external factors that can increase production. The expected grass production is not necessarily what can be attributed to, for example, rainfall or soil properties, although it is generally accepted that more rain leads to higher grass production. Regular veld monitoring and carrying capacity estimates allows us to determine the variation between dry and wet years, and the long-term carrying capacity of the farm. Stock the farm accordingly and stay within the limits. The problem is sustained grazing rather than continuous grazing.

B **Sporadic, long rest periods are necessary for grass to recover and reproduce after grazing.** Logic dictates that seed setting and the establishment of new plants are necessary to maintain existing plant populations. In most grazing management systems, the period during which animals are absent from a camp is usually too short for the grass component to recover from defoliation. Incorporate sporadic rest periods equal to a full growing season.

C **Veld is the cheapest source of feed there is and purchasing feed can become an expensive exercise.** Apply sound principles, adjust stocking rates, and ensure that there is enough veld grazing available after the growing season to support animals for the next eight months. Pasture management is a philosophy. You may be using recipes, but management on any farm is environment specific. Adapt your actions within a philosophical framework. Just study the country's different areas to understand how difficult it is to lay down universal rules. Let's rather assume that each producer will adapt these guidelines based on his or her own situation.

5.3.2 Autumn planning

February is a hot month, and especially subtropical grass species will start to decline in growth and quality. By the first frost, these species will become completely dormant until temperatures and day lengths start to increase again in spring. The basic principle is that, if you require quick recovery after winter, you have to ensure that the veld is not overused in autumn. March to May (or until the first frost) is therefore a critical period during which stocking rates must be reduced to decrease the pressure on the veld (rest).

Quarterly planning for autumn

- Reduce stocking rates on veld grazing in time.
- Ensure that the veld rests sufficiently – each camp for at least a full growing season every three to four years.
- Cut hay on cultivated pastures in time, so that there is at least six weeks' growing time left before the first frost.
- Administer strategic fertilisation on your cultivated pastures, so that you will end up with good quality standing hay during winter.
- Consider sowing temperate species into subtropical grasses to provide green fodder during late winter and early spring, especially if you don't have extra land available for dedicated winter grazing.

5.3.3 Winter planning

In order to prepare for winter, most grazing producers prefer a situation where:

- Most of the natural subtropical grazing is lightly grazed, allowing the plants to build up reserves so as to recover quickly during the spring growing season.
- Cultivated pastures have already been cut for hay or silage to replenish the winter fodder bank when pasture quality is low in the summer rainfall and frost-prone areas.
- All pastures for standing hay were well fertilised and have grown well.
- Temperate pastures have already been established if extra land and adequate irrigation were available.
- Existing and new pastures in the winter rainfall areas have been established and were well fertilised.

Given the drop in temperatures and rainfall in the summer rainfall areas along with changes in day length, subtropical grasses will be expected to have reached the end of their active growing season while the growth rate of temperate grasses is increasing. This applies to both natural and cultivated grazing.

Producers in sweetveld areas must ensure that the grass component is sufficient so that high-pressure grazing can be applied without depleting and disturbing the veld.

Cultivated pastures: This time of year, cultivated pastures can become a source of survival for the animals on the farm. Unlike pastures that have already been cut for hay for the fodder bank, pastures intended for standing hay can be utilised once the grass becomes dormant.

Standing hay: The manner in which standing hay is utilised will depend on the farm's infrastructure and its cattle production system. Where herds comprise several groups of animals, those animals with the greatest needs should be put to pasture first, followed by the rest according to their lower needs.

On farms keeping different types of animals, it is important to use cattle as the first grazers, followed by sheep that are able to select better. This allows for even defoliation of the grass. This type of system works especially well on mixed pastures containing grasses and legumes.

Quarterly planning for winter

- Maintain a conservative stocking rate to lower pressure on the natural grazing until it becomes dormant.
- Apply high-pressure grazing to ensure optimal utilisation of the grazing.
- Certain cultivated pastures can now be grazed in strips or harvested as green fodder, followed by follow-up fertilisation and irrigation.
- If temperate pastures are being grazed, grass from the fodder bank should be provided as a source of fibre in the ruminant diet to maintain good digestion.
- Prepare fire breaks now in anticipation of unplanned and planned fires towards the end of winter.

5.3.4 Spring grazing

Most of the crop residues (if available) in the summer rainfall areas should be ready and producers will now rely on their fodder banks. The fodder bank can comprise of hay, silage or even green annual and sometimes perennial winter pastures under irrigation, which will help animals through the so-called killer months.

In the winter rainfall areas, most of the veld and cultivated pastures are in good condition and are being well utilised. However, preparations must start now to ensure that the pastures are not put under pressure in the coming drier and warmer summer months due to overgrazing in spring.

Quarterly planning for spring

- In the case of natural veld, stocking rates can be systematically increased after the first good rains. In camp systems, the rotation period between camps can now be extended due to the increasing growth of subtropical grasses in the summer rainfall areas. Producers in the winter rainfall areas will start to consider maintaining a reduced stocking rate, as production declines as rainfall decreases.
- On subtropical cultivated pastures such as *Eragrostis curvula* (*oulandsgras*), excess dormant grass can be either burned or cut just before applying fertiliser and before the first rains.
- Perform soil analyses now so that a fertiliser programme can be compiled for the upcoming growing season (summer rainfall areas).
- If pastures are already quite old (between five and 15 years, depending on the pasture species and type of soil it is planted in) a roller harrow or similar implement can be used to loosen the crust of the soil before applying fertiliser and before the first rains arrive, provided the soil is not too hard. Otherwise, this can be done after the first rains.
- Over the next three months, pasture growth in the summer rainfall areas will increase drastically. By the end of December, most subtropical grasses should be in their peak growth period. In the winter rainfall areas, the subtropical grasses' growth rate will decrease due to the drier season. Perennial, temperate grasses may then require irrigation.

SOURCES

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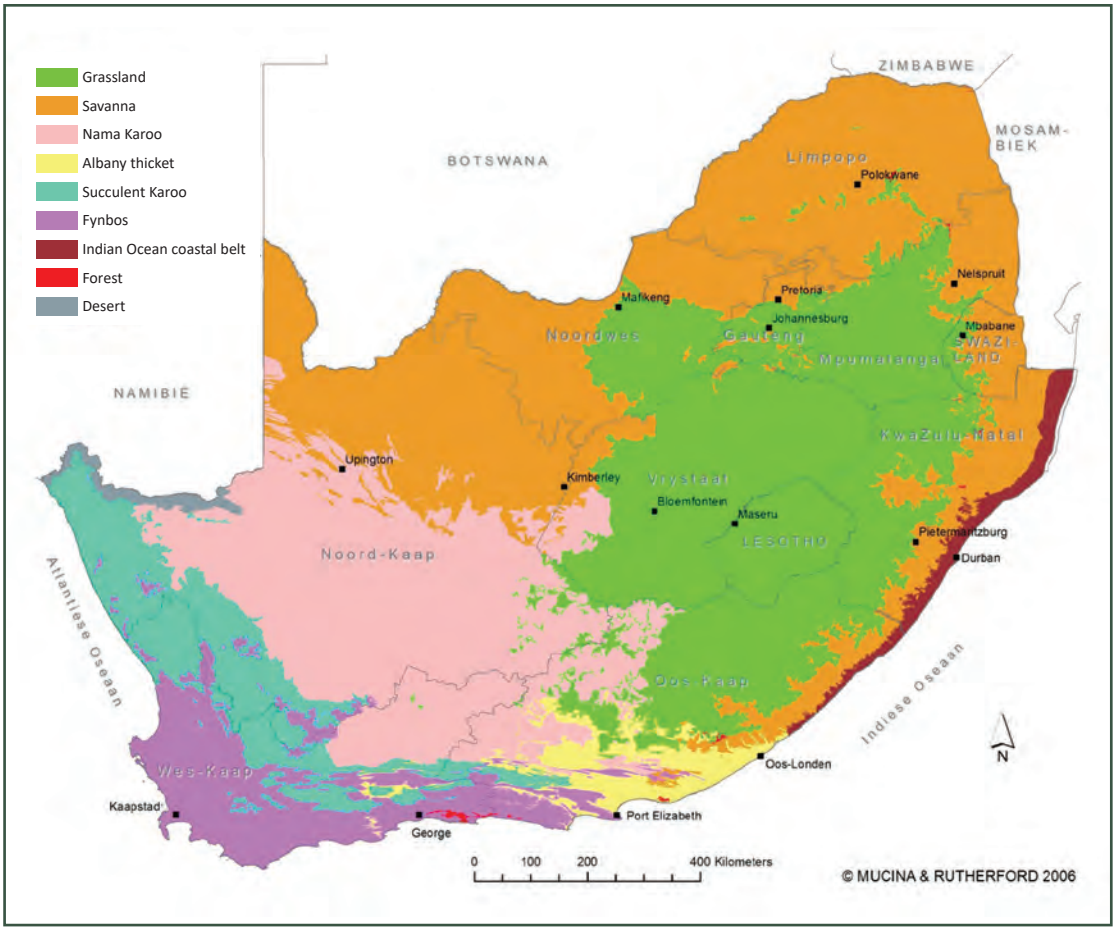
- Truter, W. 2012. Beplan jou herfsmaande.
- Truter, W. 2012. Weiding in die winter.
- Truter, W. 2012. Weidingskalender vir die lente.

5.4 WINTER PLANNING ACCORDING TO BIOMES

The dynamics/differences of our country's veld types make it rather difficult to make recommendations regarding herd management, supplementation and fodder flow planning.

Figure 5.1 clearly illustrates how diverse the country is in terms of climate regions and types of vegetation. With this in mind, five primary climatological regions were identified. In this article, a representative from each makes recommendations on how to manage winter's challenges in each region.

Figure 5.1: Biomes of South Africa, Lesotho, and Swaziland (Mucina & Rutherford, 2006).



Southern Cape (fynbos, parts of succulent Karoo as well as thicket) – *Stephen Slippers*
The southwestern Cape is not a clearly demarcated geographical area, but for purposes of this explanation we interpret the area as the Overberg District Municipality with Bredasdorp as the main centre. It is a winter rainfall area with diverse agricultural activities, the most important including small grains, canola, fruit, vineyards and fodder crops, both dryland and under irrigation. The stock component represents an equally diverse picture (dairy, beef cattle and small stock, mainly wool), with many enterprises focussing on livestock production.

Fodder flow planning is a farm-specific issue and should be evaluated annually, specifically with the approaching winter and conditions during the preceding seasons in mind. By early winter the area is usually already green, but the amount of plant material available might be inadequate and low in fibre.

Significant bridging feed sources (oat silage, maize silage and grain straw) are low in protein and supplementary protein-rich roughage sources such as lucerne should be bought in as early as possible in order to utilise lower prices. Grain straw is available in large quantities in the area and can be transformed into more accessible roughage by using fairly simple ammonification techniques on site to be used throughout the year, (including winter time) to help fill gaps in the fodder flow programme.

Karoo (Nama-Karoo, succulent Karoo) – *Jan Hoon*
Karoo veld occurs over a wide area with great variation in veld types. From west to east the vegetation changes from predominantly sparse succulents and Karoo bushes, Bushman's grass, mixed Karoo shrubs to grassveld with larger shrubs found in varying numbers throughout the area. Feed production and the nutrient value of Karoo veld varies substantially, and periods of abundance are usually followed by periods of scarcity.

During the growing season, perennial grasses and shrubs have similar nutritional value. However, grasses generally produce more biomass and offer greater grazing capacity. In winter, the nutritional quality of grass tends to decline sharply, particularly the protein content, while shrubs maintain a higher nutritional value than perennial grasses.

Because of the large variation of veld types in the Karoo areas, as well as the influence of climatological factors, one has to look at the following aspects for a winter planning programme individually:

- What is the current state of my grazing, given the limited growing time left before winter, especially in the areas with more grassveld? Are my stock numbers in line with the available grazing that has to maintain my animals until the next growing season arrives?
- With what will I supplement the veld grazing? Is there a bigger grass component on my farm or is it primarily shrub veld? Will my ewes be in late gestation, lactating or with the ram in the dry season?
- What is the availability of supplementary feeds and what will it cost? Which feeds can I buy now, possibly at a better price than during the winter months when the demand is high?

Sweet veld (central to western areas of South Africa, most parts of the Nama Karoo, Savanna westerly grasslands) – *Dr Pieter Henning*

Approximately 45% of the natural grazing in South Africa comprises sweetveld. Unlike sourveld, sweetveld retains its nutritional value and palatability throughout the year. However, sweetveld has relatively sparse plant cover and is very sensitive to overgrazing. Sweetveld is found in relatively frost-free, low-lying areas characterised by warmer winters and less variable rainfall.

The primary challenge with sweetveld is its variable grazing capacity due to variable rainfall. The first step in planning for winter on sweetveld is to balance the intended stocking rate with the availability of grazing. Always remember that, although sweetveld retains its nutritional value and palatability throughout the winter, the amount of grass is much less than in the case of sourveld. Also, sweetveld is much more sensitive to overgrazing.

The amount of feed in the veld is highly dependent on rainfall and its seasonal distribution. Manage a judicious grazing programme during the summer, including provision of spare camps, so that there is enough material for the winter.

Sweetveld's digestibility ranges from approximately 55 to 60% in summer, to around 45 to 55% in winter. The protein content of material ingested by livestock ranges from 13% in summer to 8% in winter, although the average protein content of winter sweetveld can drop as low as 4%. The nutritional value of winter sweetveld is generally high enough for animals to maintain their condition and even grow. In terms of lick supplementation, providing a protein-mineral lick during winter can promote the intake of lower-quality material and increase the production potential of the winter sweetveld.

Sourveld (central to eastern South Africa, largest portion of grasslands and parts of the Savanna) – *Sheila Household*

Natural grazing is the greatest feed resource for livestock production in South Africa. Rainfall and soil are the most important factors that determine whether grasslands will be sweet- or sourveld. Sourveld grasslands occur at higher elevations with a cooler climate and an annual rainfall of over 750mm. Grass grows rapidly in spring and summer, reaching maturity relatively early in the growing season, with a subsequent decrease in grass quality and animal performance. Sourveld can only maintain animals in production for six to eight months of the year.

Fodder flow planning is very important in sourveld areas and winter supplements are necessary. There are three ways in which livestock producers can provide sufficient good quality winter feed in sourveld areas: by carefully managing the veld in summer, growing/purchasing extra feed for the winter, and adjusting stocking rates to existing feed availability.

Each camp should be rested at least once every four years and if used by sheep, every second year. Sourveld grasslands can support more animals per hectare than sweetveld grasslands, but they must be given a full season's rest to maintain its vigour.

Livestock supplements are necessary throughout the winter in sourveld areas. Sourveld is basically deficient in phosphorus, meaning animals must receive a supplement year round. Protein is a largely limited nutrient in winter, followed by energy. Hence, all livestock must be given these substances in the form of lick supplements.

Savanna bushveld (Savanna to the north) – *Dr Vlok Ferreira*
Beef producers are constantly exposed to changing climate conditions such as seasonal droughts or exceptionally high rainfall in the summer rainfall areas. Both have a direct impact on the productivity of their herds. Weaning stress occurs when calves and cows are separated and is exacerbated by pregnancy as well as decreasing pasture quality from February/March in the Savanna bushveld.

These stressful conditions put pressure on cow health, reducing the animals' resistance to disease and, as a result, internal and external parasite infestations will increase drastically. This can lead to production losses, the direct result of which is a reduction in the calving rate.

Research at Kansas State University in America has shown that deficiencies of the most important trace minerals in beef cattle rations will have a major impact on the immune and reproductive systems, and heifer growth. When providing lick supplements to beef cattle, it is therefore essential to consider mineral intake along with the intake and quality of pasture.

Although a reasonable amount of trace minerals is found in grazing, the amount and availability thereof depend on a variety of factors such as rainfall, the condition of the soil, and the digestibility of the pastures. The composition of lick supplements therefore provides for the critical trace minerals of which deficiencies will occur so that the basis of optimal production and profitability will be supported.

SOURCE
- Einkamerer, O. 2014. Let's plan for winter.

5.5 LIVESTOCK'S MINERAL REQUIREMENTS

Animals' mineral requirements depend on their productivity levels, which means that as production and reproduction levels increase, their mineral needs increase accordingly. Marginal mineral deficiencies where the animal's productivity is low are aggravated as the animal's production and reproduction rates increase. It is very important to note that the minimum zinc requirements for sperm formation and testes development are higher than for growth, and accordingly the manganese requirements for growth are lower than for fertility.

The most important minerals required are antioxidant trace elements (manganese, zinc, selenium and copper) and antioxidant vitamins (A and E). The occurrence of stress (e.g. as a result of excessive handling during vaccination, dosing, dipping, castration and shearing, as well as weaning and bad weather) and diseases increase the demand for these trace elements and vitamins. Consequently, they are not available for reproduction or are only available in insignificant amounts.

Grazing animals get their minerals through their intake of veld grass, water, soil, and licks. The levels of certain minerals, known as antagonists (e.g. calcium, iron, sulphur, molybdenum, sodium and potassium), found in one or more of these sources are often too high, thus affecting the absorption of other minerals and giving rise to mineral deficiencies. For example, a high intake of calcium from drinking water with a high lime content can cause a shortage of manganese, zinc, selenium, copper, cobalt, iodine, phosphorus, magnesium and vitamin A.

A deficiency in one or more of the essential minerals, trace elements and vitamins may have a negative influence on livestock performance.

Manganese deficiency:

- Poor conception rate as a result of delayed oestrus cycles (including silent heat) and lower ovulation
- Poor sperm quality
- Decline in libido
- Abortion
- Decline in foetus growth
- Retarded growth
- More bull calves and ram lambs than female progeny
- Black hair that turns rusty brown
- Undershot jaw
- Painful and knuckled fetlock joints

Copper deficiency:

- Anaemia
- Unthriftiness
- Poor semen quality
- Abortions
- Low fertility
- Decline in wool and hair production
- Diarrhoea
- Loss of wool, and fibre crimp
- Discoloration of wool and hair (black hair turns rust-brown or grey)
- Embryonic death
- Low viability of lambs at birth

Zinc deficiency:

- Reduced appetite and growth rate
- Poor feed conversion
- Abnormal spermatogenesis
- Retarded testicular development
- Low libido
- Resorption of embryos (thus poor conception rate)
- Shedding of wool and hair
- Sheep eat their own wool
- Roughened skin (parakeratosis)
- Foot rot
- Vitamin A deficiency

Selenium deficiency:

- Embryonic deaths (thus poor conception rate)
- Silent heat
- Abortion
- Premature births with poor viability
- Increased mortality in lambs
- Diarrhoea
- Poor growth (lamb stunting)
- Poor wool and hair production
- White or striated muscle disease (muscular dystrophy)
- Retained placentas
- Lowered resistance to disease

Cobalt deficiency:

- Decline in appetite
- Emaciation
- Poor growth
- Anaemia
- Listlessness
- Excessive secretions from nose and ears
- Decline in milk, wool and hair production
- Decline in oestrus
- Foetal deaths
- Abortion
- Stillborn lambs
- Newborn lambs take longer to stand up and to start suckling
- Increased lamb mortality
- Weepy eyes and scaly ears

Iodine deficiency:

- Enlarged thyroid
- Abortion
- Lambs stillborn or weak and without wool at birth
- Lower conception rate and lower wool and hair production
- Increase in lamb mortalities
- Foot rot
- Lower feed intake and decline in growth

Vitamin E deficiency:

- Retained placenta
- Lower resistance to disease

Phosphorus deficiency:

- Low growth rate
- Rickets (bowed legs)
- Abnormal appetite or pica (e.g. eating bones)
- Listlessness
- Reduced feed intake
- Lower fertility, growth and milk production

Magnesium deficiency:

- Magnesium tetany (muscle cramps)
- Loss of appetite
- Retarded growth
- Reduced fertility

Vitamin A deficiency:

- Decline in feed intake
- Low growth rate
- Low conception rate
- Delayed oestrus
- Abortions
- Weak and stillborn lambs
- Abnormal semen
- Low libido
- Retained placenta
- Blindness
- Increased susceptibility to disease owing to infection of the mucous membranes of the respiratory organs, the eye, genitals, and digestive tract (resulting in diarrhoea)

The trace element status of livestock requires continual monitoring because this is an essential part of the management programme. The best method to determine the trace element status of animals is through a liver biopsy, although some trace elements (such as selenium and iodine) can also be measured in the blood. Blood test results need to be very carefully interpreted, however, because homeostatic control mechanisms in blood can keep the trace element levels high when the mineral reserves are in fact severely depleted.

Measuring the mineral status of grazing animals and using this information to formulate licks are the best option. If this is not possible, providing a full range of minerals to grazing animals is certainly justified.

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PHASE 4

As soon as the quality and availability of grazing starts to decline, Nutri production licks can be offered to the animals. Production licks are also recommended for animals fed at levels above that of maintenance, including cows or ewes in late gestation, lactating animals, growing animals or animals with an inadequate condition score.

PHASE 1

Summer grazing is primarily phosphorus (P) deficient along with area-specific trace mineral deficiencies. Give animals on green, succulent grazing the Nutri summer lick range.

PHASE 3

Once grazing quality has declined even more, switch to a complete winter lick that is high in minerals and NPN. The objective of winter licks is to supplement primary rumen micro-organism deficiencies, thus stimulating the utilisation of grazing. Hence, winter licks complement grazing and are not a substitute for grazing.

PHASE 2

Switch to a transition lick as soon as the quality of the grazing starts to decline, typically after the flowering stage of the vegetation.

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Nutri Lick Phos 12(V 5008), Nutri Lick Phos 6(V 8874) Nutri Tub Phosphate (V 14996), Nutri Tub Protein(V 14994), Nutri Lick Winterbreker 32(V 3342), Nutri Lick Beef 50(V 5252), Nutri Lick Winter 40(V 17401), Nutri Lick Concentrate 80(V 19002), Nutri Tub Energy(V 17053), Nutri Lick Energy 18(V17402). Consult the product label for comprehensive instructions for use and warnings.

The mineral requirements of animals are of far less importance if the animals are energy and/or protein deficient. It therefore appears to be uneconomical to supply mineral supplements to grazing animals that are deficient in energy and/or protein. On the other hand, if energy and protein levels are sufficient, a high level of minerals is required to maintain a high growth rate. Mineral deficiencies and/or imbalances can be corrected by supplementing with lick mixtures or lick blocks that have been specially formulated to correct these deficiencies naturally. The provision of minerals in the form of licks is the most economical way to correct mineral deficiencies.

Producers who use mineral licks must be able to rely on the reputation and integrity of the manufacturer to supply essential minerals in the correct proportions to grazing animals via the licks. Taking the production stage and season into account, producers should provide licks that complement the minerals available in the grazing and water ingested.

It is important to note that the proportions in which minerals are supplied to animals are actually more important than the quantity of those minerals. Licks should provide animals with high levels of minerals and trace elements in the correct proportions to optimise animal production.

Although supplementing minerals year round is preferable, young growing green pastures are particularly mineral-deficient, and it is therefore recommended that minerals be supplied in the form of a salt-phosphate trace element lick during the rainy season. Ideally, the supplementation of trace elements should be twofold: Firstly, a lick should be provided to supplement the animals' trace element reserves all year round. The latest recommendation is that 20 to 30% of the trace elements in a lick be supplied in organic form because their bioavailability to the animal is higher than that of traditional inorganic trace elements, thus ensuring better animal performance.

Secondly, highly available trace elements such as chelated trace elements should be given by injection or dosing four weeks before mating and again four weeks before lambing or calving to make provision for the high trace element requirements during mating and lambing, weaning, and the commencement of finishing. The injection or dosing of trace elements is also highly recommended where the intake of lick is low or unequal (some animals in a herd or flock do not eat the lick at all and others ingest very little) or where there are very high intakes of certain minerals (e.g. through calcareous or brackish water). It is also advisable to administer vitamins A and E by injection or dosing at the same time as the trace elements because they work in synergy with zinc and selenium, respectively.

Minerals are relatively unpalatable, resulting in a low as well as highly variable intake of minerals, a situation which is aggravated if producers do not mix the licks according to the manufacturer's instructions. In areas where the drinking water is salty or merely brackish, or where salt is fed separately in lick troughs or in the form of rock salt, lick intakes will be drastically reduced as a result of the high salt intake. It is therefore important to constantly monitor lick intake. If intakes are too low, the amount of salt should be reduced and a palatable raw material such as molasses meal should be included in the lick to stimulate intake. Intake stimulants such as molasses meal also ensure a more uniform lick intake. It is a waste of money if the animals don't ingest sufficient minerals because this makes it impossible to maintain a high production and reproduction rate. Furthermore, animals prefer fresh licks and better lick intakes are achieved if licks are put out more regularly than once a week.

5.6 NUTRITION: PRINCIPLES AND PRACTICES

5.6.1 Ruminant gut health: What you should know

Optimal production is any livestock producer's goal but various factors need to be considered to achieve it. The feed that is offered to the animal, be it grazing or a total mixed ration, plays a big role in the animal's production stage. For an animal to produce optimally, its gut (rumen, small and large intestine) needs to function optimally as it is essential for feed digestion and for the health of the animal.

5.6.1.1 In the rumen

When feed is consumed by the animal, it is firstly chewed and then swallowed after which it enters the rumen. The rumen contains thousands of microorganisms that break down complex carbohydrates into simple fatty acids, which the animal can then use. These microbes are responsible for approximately 70% of the energy that the animal uses for maintenance and production.

The feed the animal receives determines the type and number of microbes present in the rumen (and lower gut). Grazing animals have a higher number of microbes that can degrade fibre while animals that receive maize-based diets have more microbes that can degrade starch.

5.6.1.2 Acidosis

If the animal's feed changes suddenly, for example if an animal is used to grazing and the diet is suddenly switched to a maize-based diet, it can result in acidosis. Acidosis is when high acidity is present in the rumen for too long and can permanently damage the rumen walls, leading to decreased absorption and poor growth. Maize and other grains are degraded by lactic acid producing microbes. Under normal circumstances, the lactic acid will be converted to other fatty acids (that will be used as energy) by lactic acid-utilising microorganisms. The sudden change in diet means there won't be enough microbes that can use the lactic acid, resulting in its build-up in the rumen. This ultimately results in acidosis.

It is important to adapt the microbes in the rumen to a dietary change. This can be done in steps, for example, a small percentage of the new diet can be given along with the old diet, then gradually increase the new diet on subsequent days, until the animals are receiving only the new diet and are adapted to it

5.6.1.3 Gut and general health

The microbes present in the animal's gut play a role in the animal's health. Like in all ecosystems, pathogens are present in the gastrointestinal tract of the animal. The abundance of these pathogens, such as *Clostridium perfringens*, is kept low by normal (also known as commensal) and beneficial microbes. These commensal and beneficial microbes produce enzymes that inhibit pathogens, help with the digestion of feed, and are involved in other functions within the gut.

The commensal and beneficial microbes compete with the pathogens – the high number and diversity of microbes in the gut therefore act as a buffer to prevent pathogens from growing and affecting the animal negatively. If the number of microbes in the gut drop below a certain point, pathogens make use of the opportunity to grow, resulting in a sick animal.

This decrease in microbes can occur in various circumstances, for example, with antibiotic use. Antibiotics inhibit pathogens such as *E. coli,* but they also inhibit commensal and beneficial microbes.

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The management of the use of antibiotics is important: it should only be used when necessary. The responsible use of antibiotics can also prevent animals and microbes from becoming resistant to the antibiotic.

The small and large intestines contain various specialised cells in the walls of the gut that play a role in the animal's immune system. These cells produce and maintain two mucous layers in the gut that prevent microbes and other bodies from entering the bloodstream. Some pathogens consume the mucous, thinning the mucous layers in the process. As a last line of defence, the epithelium cells of the gut wall also prevent the microbes from gaining access to the bloodstream.

In certain conditions, such as heat stress or stress due to transportation, the epithelium cells can create small openings through which the pathogens can enter the blood and spread through the animal. It is therefore important to ensure that the right beneficial microbes are already present in the gut, as they produce antimicrobial enzymes that inhibit pathogens and help maintain the mucous layers.

Feed additives, such as probiotics, prebiotics and essential oils can help establish beneficial microbes in the gut to help with the degradation of feed, inhibition of pathogens, and maintenance of the mucous layers. Certain probiotics can also help animals handle stressful events, such as weaning, resulting in a more productive animal. The microbes in the gut of young animals before weaning have not yet fully established themselves and can still be manipulated. It is therefore easier to establish the right beneficial microbes in the gut in the short and long term by providing a creep feed and strategically using additives such as probiotics.

The optimal functioning of the gut is essential to the health and production of animals. It is important to make sure that the right microbes are in the rumen, small and large intestine to degrade feed and inhibit pathogens. A healthy animal is a productive animal. A productive animal means money in the bank for the producer.

SOURCE

- Envarto. 2025. *www.envarto.co.za*.

5.6.2 Benefit from creep feed

Due to the highly efficient feed conversion of young lambs and calves, everything possible should be done to ensure that the young animal can grow according to its maximum genetic potential. Creep feed can be of great value.

The following section is based on information obtained from two well-known figures in the livestock industry, the late Dr Jasper Coetzee, a sheep nutrition and management consultant, and Dr Hinner Köster, ruminant nutrition specialist.

5.6.2.1 Creep feed for lambs

The advantages of creep feed entail the following:

- Lambs can be weaned up to 50 days earlier because they grow approximately 100g per day faster.
- More lambs can be marketed directly from the ewe, which means a higher slaughter percentage (>50%) with a higher profit.
- Creep feed ensures that the ewe loses less weight and condition during early lactation, which means more twins being born in the next lambing season.
- Lambs are not subjected to weaning shock, which prevents weight loss. For every day a lamb is subjected to weaning shock, it takes about three days to recover. This can lead to a production loss of 21 days or more.
- Lambs may be rounded off in a feedlot without adaptation problems, and more ewes may be kept on the veld.
- It helps to control coccidiosis.

Ewes' milk production declines about three to four weeks after lambing, while the lamb's feed requirements increase. This nutritional shortage experienced by suckling lambs must then be supplemented with creep feed to realise maximum growth. At the age of four to six weeks around 50% of the lamb's feed requirements can be met by creep feed and grass.

Good feed for lambs up to the age of three months will ensure that the young lambs develop the maximum muscle cells genetically possible. A decline in the ability of muscle to grow due to lesser feed during the developing of muscle cells, means that more nutrients are available for the formation of fat when grazing conditions improve, because there are less muscle cells that can use it. The result is that these animals, with the same bodyweight, are prone to being fatter than their grown-out contemporaries but have less muscle.

Ewe lambs subjected to feed stress in the first months or their lives will have a lower ovulation tempo and produce fewer lambs than those that receive proper nutrition. This is probably one of the most important reasons why ewe lambs that received creep feed have the highest lambing percentage during their reproductive life.

Creep feed is one of the most profitable forms of feed, because young animals' feed conversion is best. Good quality lambs eat about 2,1 to 3,1kg of creep feed to gain 1kg of mass, which means a profit of R2 to R3 for each R1 spent on creep feed. Creep feed is a management tool that can be used to make sheep farming more profitable.

Creep feed for suckling lambs should commence within seven to 14 days after birth. Due to the high essential amino acid requirements of growing lambs, high quality bypass protein with the correct amino acid profile must be added to the creep feed. Due their low bypass protein content producers should definitely not use backgrounding pellets, ewe and lamb pellets, drought pellets and chocolate grain as creep feed.

5.6.2.2 Creep facilities for lambs

The openings in creep pens must be 20 to 30cm wide for the larger breeds, but if lambs are weaned at 25kg, then 20cm should be sufficient. Normally the openings are 20 to 25cm wide, but for small and lean ewes it is limited to 18cm and for Angora ewes to 12cm to prevent them from creeping through.

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Creep gates must be placed where lambs can gain easy access to it, for example near water points, feed spaces or where the ewes sleep.

The daily creep feed intake of lambs is a better indication than bodyweight of when they are ready to be weaned. Lambs may be weaned when they eat at least 250 to 300g creep feed per lamb daily for three to four consecutive days and weigh at least 25kg.

5.6.2.3 Creep feed for calves

The supply of creep feed to calves is a valuable management tool to optimise production of your entire beef cattle production system.

Some stud breeders don't like the idea of giving creep feed to stud calves, because every calf's growth prior to weaning reflects the cow's milk production. While this is indeed the case, the same trend is found in creep feeding systems where good milk producers' calves will grow better if their genetic growth potential is similar to that of poorer milk producers' progeny in the same group. Everything happens on a higher level, meaning the producer will generally enjoy the benefit of better growth.

The goal of a stud enterprise is after all to determine the maximum genetic potential of registered beef calves, with nutrition playing a major role in achieving this goal.

Commercial weaner calf producers already breed their cow herds to be adapted to the area and to ensure that milk production is sufficient to raise calves. If the replacement of breeding material is to play a smaller part, then bulls for the commercial market are already being purchased for their growth potential and not necessarily for their genetic milk potential.

A third scenario where creep feed may be of help is when the quality of grazing isn't good enough and the cows are under stress. If calves have access to creep feed, it takes the pressure away from the cow and can assist her own production, but at the same time help the calf to reach its full growth potential.

It is mainly for these reasons that creep feed given at strategic times can yield more positive results and greater profit for a beef cattle enterprise.

5.6.2.4 Creep systems for calves

Creep feed can be presented to calves in many different ways. It can be as simple as a gate system that gives calves access to the creep ration, but is too small for cows or breeding heifers.

Moveable structures may be erected at water points in the camp and moved from camp to camp with the herd, or else permanent structures may be erected. The principle is relatively simple to erect and manage.

When the oldest calf in a group is three months old, creep feed can be supplied. The quality of the material with which the ration is mixed, is very important. Approximately 10 to 20% good quality finely cut lucerne (± 1 to 2cm in length) can be included in the ration.

Crop residues are a relatively cheap feed source for overwintering but they have certain limitations in terms of nutritional value and livestock management.

5.6.2.5 Creep rations

A creep ration for lambs should contain 16 to 18% protein, of which at least 35 to 40% must be bypass protein.

Typical creep ration for lambs
75kg finely ground lucerne (10mm)
625kg finely ground maize
150kg soya oilcake meal
150kg feedlot concentrate
Total: 1 000kg

A creep ration for calves should contain 16 to 18% protein, of which at least 30 to 35% must be bypass protein. Commercial plant protein (e.g. soya) with high levels of high-quality bypass protein may be bought from suppliers.

Typical creep ration for calves
150kg finely ground lucerne (10 to 20mm)
600kg finely ground maize (6mm sieve)
100kg soya oilcake meal
150kg high protein concentrate with enough bypass protein, vitamins, coccidiostats and minerals
Total: 1 000kg

SOURCE
- Hofmeyr, I. 2014. The advantages of creep feed.

5.6.3 Crop residues as an effective source of grazing

Crop residues make an important contribution to the overwintering of livestock in the summer rainfall regions, as these residues can be used as a valuable source of roughage when veld grazing decreases in winter. Although dry bean, lupin, sunflower and sorghum residues can also be used, maize and soya bean crop residues remain the two most common crop residues used for overwintering livestock.

Crop residues are a relatively cheap source for overwintering feed, but pose certain limitations in respect of nutritional value and livestock management. The cost of baling residues is often not justified, while the grain that remains on the fields after harvesting is not recycled during the baling process. The use of maize residue bales, particularly by small stock that tend to feed selectively, can lead to a lot of waste and is therefore less efficient than direct grazing.

5.6.3.1 Grazing of residues

Once the grain has been harvested, approximately 4 to 5,5 tonnes of crop residues per hectare are available for grazing. Approximately 5% is made up of grain. Results show that maize residues have a carrying capacity of approximately five to 12 small stock units (SSUs) or one to two large stock units (LSUs) per hectare for approximately three to four months, whereas the carrying capacity of soya bean residues is approximately five to eight SSU per hectare for two to four months.

Sheep utilise soya bean crop residues better than maize residues, the utilisation of which is only approximately 40%. Raw soya bean kernels have a significantly higher protein content than maize (36 vs 8,5%) but contain anti-nutritional factors such as trypsin and chymotrypsin inhibitors as well as urease, which can inhibit growth. Rather use urea-free licks when animals

have access to raw, unprocessed soya beans, as the urease activity of the beans rapidly converts urea to ammonia, which can lead to urea poisoning.

Restrictions on the utilisation of crop residues must be managed correctly to ensure optimal animal production.

5.6.3.2 Nutritional content of residues

As in the case of natural grassland during the winter months, the nutritional value of crop residues is largely insufficient to meet livestock's maintenance requirements. The animals grazing these residues have specific needs, for example in terms of maintenance, growth, finishing or stage of reproduction. These needs will determine the type of supplementary lick or concentrate needed to replenish deficiencies and promote production.

5.6.3.3 Managing acidosis

Adapting animals to crop residues is very important, especially with regard to the amount of grain left on the fields after harvesting. Initial grazing for a mere few hours per day is a valuable practice, especially when adapting sheep. However, their selective feeding habits mean they can consume large amounts of available grain very quickly (up to 800g in 30 minutes), which can lead to acidosis and even death.

A *landelek* containing the correct buffering agents and nutrients for better utilisation and digestion of residues is important for correctly managing adaptation to crop residues.

5.6.3.4 Supplementing feed shortages

The grains 'picked up' by animals along with the correct *landelek* followed by an appropriate lick supplement, make an important contribution to supplementing the animals' nutrient deficiencies.

Since certain mineral deficiencies are common, it is essential that these supplements are included correctly and in a balanced manner. For late-pregnant and lactating ewes, the inclusion of natural protein (oilcake meal) in a lick or supplement is important to optimally stimulate milk production.

5.6.3.5 Digestibility of roughage

The availability of sufficient roughage or grazing together with lick supplements is crucially important for the maintenance of healthy rumen function and subsequent animal performance.

As the crop residues are consumed, it is important to remove animals from them in a timely manner. The digestion of roughage decreases as its quality decreases and as a result its intake will also decrease, leading to a drop in condition. Body condition should be monitored continuously, because it starts to decline rapidly as the availability of more digestible parts in the residues decreases.

The advantage of crop residues as a relatively cheap roughage source can make an important contribution to the successful economic overwintering of livestock at different stages of production and reproduction, provided that the animals' adaptation and nutritional needs are managed effectively.

SOURCE

- Bezuidenhout, A. 2020. Suksesvolle oorwintering van vee op oesreste.

5.6.4 The value of crop residues during backgrounding

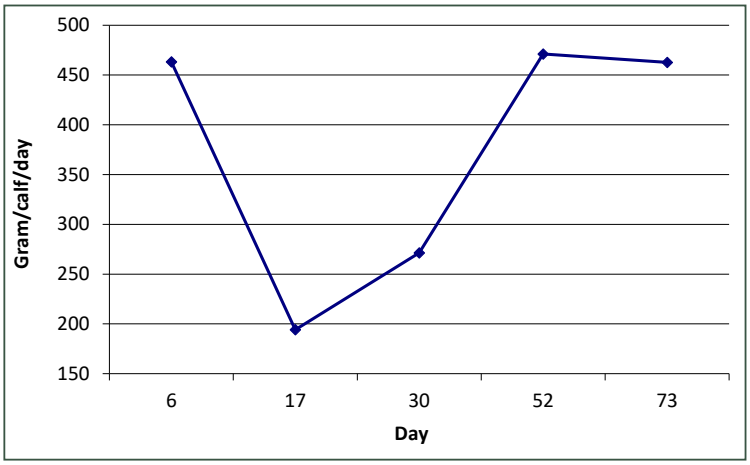
Exceptional grain harvests and an abundance of crop residues often give rise to the question as to the potential of unlocking the value of maize residues through backgrounding – i.e. feeding calves from weaning until they go to the feedlot.

Molatek undertook a study to examine the reaction of lightweight weaner calves

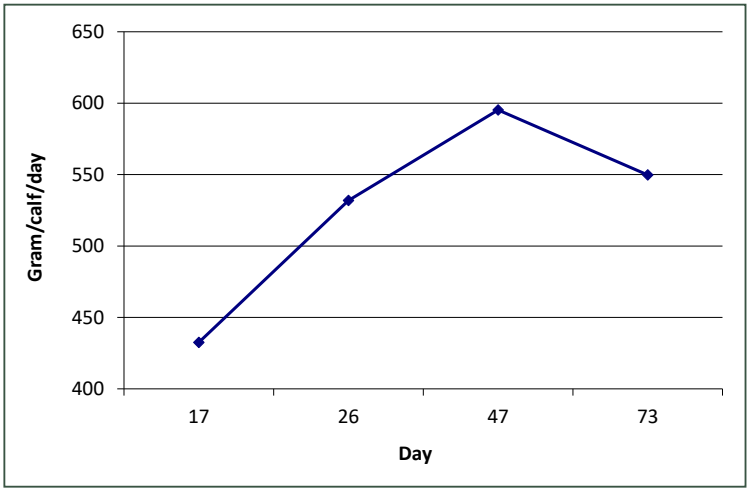
on crop residues in practice. Lightweight calves are not the recommendation, but they were available for the trial.

This study used 50 high-quality beef cattle calves weighing an average of 158kg at the start of the 73-day trial period. Grazing consisted of freshly harvested maize residues (yield of 6,3 tons of grain). The animals received a condition lick. Normal management for acidosis was applied. Animals were also vaccinated against lung-related diseases prior to weaning.

Figuur 5.2: Progressive average daily gain (ADG) of lightweight calves grazing crop residues and receiving a condition lick.



Figuur 5.3: Lightweight calves' condition lick intake on crop residues.



5.6.4.1 Study results

Figure 5.2 illustrates the typical growth curve of calves on crop residues: good growth initially followed by an adaptation phase and lastly stabilisation. The start of the curve reflects a transfer effect from the period prior to the study. Growth of 463g/calf/day, or a weight gain of 34kg, was achieved over the 73 days.

Figure 5.3 illustrates the lick intake curve: a consistent increase as animals grew, and which flattened towards the end. A condition lick intake of 527g/calf/day was realised. The reason for the flattened intake trend is attributed to the fact that the study was undertaken in August – headlands started to bud, which replaced lick intake. This is also the reason behind the 73-day trial period, as fields had to be cultivated before the next plantings.

5.6.4.2 How many animals can I carry?

The 6,3 tonnes of grain yields 3,1 tonnes of usable material, which implies that more than seven calves/ha can be carried for 73 days. Due to the nature of the value-add exercise, it is recommended that crop residues only be lightly grazed and that only one calf per 2 tonnes of grain be carried for 60 to 70 days. That leaves producers with enough material to sustain their animals.

It is important that utilisation takes place as soon as possible after harvest, as weathering

of the crop residues by wind and birds reduces their value over time.

5.6.4.3 Doing the math

Any scheme that generates 18% interest on your investment over three months sounds too good to be true. *Table 5.2* contains production figures that are set off against a R38/kg hoof price, and a lick cost of R4 300/ton.

Stocking three calves per hectare generates R3 380/ha or R1 127/calf. Generating the additional income requires a capital investment of R18 012/ha. On the positive side, the margins are such that a degree of risk can be taken that allows for negative price margins and so forth.

Although *Table 5.2* contains actual data generated in practice and of which the margins are good, it must be accepted that other costs such as labour, transport, medicine and the like should be added. The cost of mortalities must also not be overlooked.

It can nevertheless be derived from the study that crop residues can potentially generate a sizable income, and that R800/calf, or 13% interest over a period of three months, is not that far-fetched. This presents the grain producer, who runs a livestock branch, with a golden opportunity. Because it can be capital intensive, grain producers who have crop residues available can consider partnering with livestock producers, since the margins are such that both parties can benefit.

Table 5.2: Economic analysis, 2021.

	Kg	R/Calf	R/ha
Starting weight	158	R6 004	R18 012
End weight	192	R7 296	R21 888
Weight gain	34	R1 292	R3 876
Lick consumption	0,527	R165	R496
Net income	-	R1 127	R3 380

However, make sure that backgrounding on crop residues fits in with the management of the farm, as this will require time and careful business management.

SOURCE

- Mouton, J. 2021. The value of crop residues for backgrounding.

5.6.5 Backgrounding in a feedlot

There are times when producers themselves will start preparing their calves for the feedlot, before selling them. In some cases, feedlots will also prepare purchased calves separately before including them in the feedlot. Periods marked by particularly high feed prices and lower carcass prices are a prime example.

Calves in the feedlot consume 3% of their bodyweight, while veld-prepared calves require less feed. During the traditional weaning period – April and May on the Highveld – when calves are plentiful and cheap, it pays to wait until fewer calves are available in the market before the producer sells his/her own calves. This is the ideal period in which to start preparing calves and perhaps sell them after winter or finish them for the December market.

Another good time to retain calves is during a good rain year. If the producer then weans the calves and the veld contains enough roughage, it will be beneficial to retain the calves.

Another reason to retain calves is to create a wider range of options for the farming enterprise by not marketing all your calves at the same time. This especially applies to cashflow.

5.6.5.1 Backgrounding systems

Different backgrounding systems can be used, depending on the circumstances. The first, according to Dr Vlok Ferreira of Molatek, is to wean early.

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The prerequisite for early weaning is to provide the calves with enough high-quality protein in a bid to support optimal growth. Although it cannot strictly be classified as backgrounding, replacement heifers' calves are often weaned early so as to support their development during winter until second calving.

In this system, calves are weaned between 160 and 180kg but it is essential to know why that calf is so light. "It is one thing to wean early, but something completely different if that calf is part of the tail end of a poorly growing group."

For calves that are being weaned early, a ration containing 18% protein (at least 25% must be bypass protein), and with 9 to 9,5MJ/kg energy, is required in order to support proper frame development and to keep calves from fattening up too quickly.

The second system is to wean calves at the normal weight of 220 to 230kg in autumn. They will then overwinter on maize residues or standing hay, with a normal protein lick as a supplement. Another option is to provide calves with a backgrounding supplement at 1,5% of their bodyweight throughout winter. After winter they can be sold to the feedlot or finished for the December market. This system has a 650g and 1,2kg/day growth target.

"Using this method to get your autumn calves through summer, with its protein- and energy-rich grazing, means you only need 0,75% of calves' bodyweight in the form of lick, making this option half as cheap than during winter. If you have a winter cover crop, however, the same guideline applies as for summer."

The third system involves overwintering calves on a maintenance protein lick. In this type of system, the calves should still gain around 30kg of weight during winter, although it entails mainly frame growth which might make it seem as though the calves are getting thinner. If enough summer veld is available, however, strong compensatory growth will take place.

"Keep them on the veld for the first half of summer and feed a phosphate lick supplement. Then, in the second half of summer when the quality of the veld starts to deteriorate, put them on a backgrounding ration that contains 18% protein and 9 to 9,5MJ energy. Then, at the end of the summer, sell the calves directly to the abattoir."

This of course extends beyond feedlot preparation, he says. Replacement heifers and bulls destined for breeding can be raised just as efficiently on a backgrounding ration on pasture.

5.6.5.2 Buying in calves

Producers that buy in calves need to make sure it is the right type of animal, says Dr Ferreira. For example, heifer calves grow between 5 and 10% slower than ox calves. They are also less efficient feed converters. Heifer calves of the same age will weigh between 15 and 20kg less than their male counterparts. It is best to build a relationship with a reliable supplier of good quality calves that meet your system requirements.

However, calves from dairy breeds such as Holsteins do not fit into a backgrounding system, as they require a lot of protein and energy for optimal growth. Then again, if an early- to medium-maturing beef bull is used on dairy cows, those calves will already be more suitable for backgrounding.

"Early maturing breeds are highly suited to backgrounding, as you can background them for a relatively long period before finishing them in the feedlot for a short time. The challenge with late maturing types is that their nutritional needs are so high – both in terms of maintenance and growth – that frame growth is difficult to achieve. It is better to directly include them in the feedlot."

5.6.5.3 Benefits of backgrounding

Preparing calves for the feedlot has several benefits. Firstly, by the time the calf gets to the feedlot, it is already familiar with feeding from a trough. Calves are also immunised against common diseases, and because of their optimal health and nutritional status, they will not experience as much stress in the feedlot and will therefore perform to their full potential.

To illustrate this: 3,4% of all calves that fall ill in the feedlot eventually die. The average daily gain (ADG) of a sick calf that recovered is 6% less, and the cost associated with its weight gain 10% more than that of healthy calves – this results in a negative net yield for that calf.

The dark cuts (so-called dark cutters) of twice-treated calves are 12,5% compared to the 4% dark cuts of calves that have been treated once only. The norm for dark cuts in healthy calves is less than 1,5%.

The real value of feedlot preparation becomes clear when comparing the performance of well-prepared feedlot calves to that of an unprepared control group.

Morbidity decreases by 23% and mortality by 7%. Furthermore, the cost of a backgrounding system's feed is roughly 50% of the overall cost, while this number is around 80% in a feedlot. It is therefore relatively cheap to prepare calves thoroughly so that they can perform optimally in the feedlot.

There are many guidelines relating to the quality and type of grazing, and its effect on ADG. However, an often-overlooked aspect is the effect the declining quality of end-of-season grazing has on ADG.

A 10% reduction in the digestibility of veld in late summer can lead to a 400g reduction in ADG. Keep in mind that it is not only the quality of grazing that decreases, but also its consumption.

5.6.5.4 Backgrounding during drought

The value of being able to wean calves early during times of drought, without compromising growth and development, must not be overlooked. In areas with a dry, late summer, early weaning not only has benefits for the cow during that first winter, but its effect can still be observed in the conception rates a year later.

Backgrounding is economical if you keep in mind that it is easier for an early-weaned cow to get through winter and improve her body condition sufficiently in order to conceive again in the next mating season.

SOURCE

- Hofmeyr, I. 2022. Cash in on the feedlot preparation of calves.

5.6.6 Silage for your livestock

Ensiling is the process of harvesting, compacting, and storing wet plant material under anaerobic conditions. Preservation occurs when the sugar (water-soluble carbohydrates) present in the plant material is converted into lactic acid by lactic acid bacteria. This causes the pH to drop from 3,8 to 4,2.

5.6.6.1 Improved preservation

Preservation will fail when too little sugar and/or too little effective lactic acid bacteria are present. Legumes such as lucerne, soya beans, and cowpeas are more difficult to ensile as their sugar content is low and their

protein content high. Applying an effective lactic acid bacterial inoculant to these crops assists in efficiently converting the limited sugar into lactic acid.

The addition of 2% molasses (20kg/tonne wet material) can improve the preservation of legumes. The longer the ensiling process takes and time elapses before oxygen is excluded, the more sugar will be utilised by yeasts and fungi. This increases the risk of insufficient sugar being available to lactic acid bacteria and too little lactic acid being formed. The pH does not drop low enough for preservation, secondary fermentation occurs, the pH rises further, and the silage rots.

5.6.6.2 Contamination

Producers must prevent soil, mud, and manure from entering the bunker, as it will reduce silage's nutritional value and palatability, and often contains unwanted yeasts, fungi, and bacteria. The ash content of silage should not exceed 8%.

Contamination occurs when mud-covered implements are used during the harvesting, loading, and compaction stages. However, the tyres of the tractor used to compact the plant material also serve as a major source of contamination as mud that is stuck to the tyres will transfer to the fresh plant material.

When oxygen enters the silage bunker, yeasts and fungi will start growing, the silage's temperature will rise, pH will rise, and total rotting can occur. Good compaction and thorough sealing of the bunker are essential steps that must be carried out correctly. Well-preserved silage can be stored for years if it does not come into contact with air or water.

5.6.6.3 Stage of ensiling

The correct stage to ensile crops is determined by yield, nutritional value, and moisture content. Maize should be ensiled at a moisture content of 65 to 70% or a dry matter (DM) content of 30 to 35%. The lower leaves of the plant start drying off, the kernels have reached the dented stage, and the half-milk line is visible on the maize cob when the head is broken.

Maize silage consists of up to 40% grain on a DM basis. If grain is not sufficiently filled, the yield and energy value of maize silage will decrease. Up to 10% of the yield is lost if maize is ensiled at 25% DM.

Silage should never contain more than 75% moisture as it could lead to undesirable clostridial fermentation. *Clostridia* grow and multiply as long as the pH is above 5,5 and when the silage contains a lot of moisture. Butyric acid is formed and causes silage to have a bad smell. This makes the silage unpalatable and leads to low silage intake.

5.6.6.4 Moisture content

If it is possible to squeeze moisture out of chopped material by hand, then the moisture content is more than 75% (DM less than 25%). The moisture content of chopped material can be determined by means of a scale and a microwave oven. If the moisture content is too high, ensiling using row crops (maize and sorghum) should be delayed.

The DMI should increase by 0,4 to 0,5% per day. The expected ensiling date can be calculated accordingly. Grass or lucerne should be cut and then wilted until the DM content is 30 to 40%. When small grains such as oats and barley are chopped with a groat cutter, cutting should be delayed until the DM content is 30 to 35% during the soft dough stage.

Small grain storage has been found to double from the pipe stage to the soft dough stage. When making round bale silage from small grains, the material must be cut and wilted to a DM content of 35 and 45% before baling it as tightly as possible.

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5.6.6.5 Round bale silage

Round bale silage is up to 30% more expensive to make than bunker silage. On grazing farms where smaller quantities of surplus grazing are ensiled at a time and are not enough to fill a bunker, round bale silage is a practical solution. Grass should be cut when at least 1,5 tonnes DM content/ha is available and then wilted to 40% DM before baling and wrapping.

Round bales should be wrapped in four to six layers of plastic as soon as possible (within six hours) after bales were made. Six layers of plastic (24 turns on a wrapping machine) are three times denser than four layers of plastic (16 turns) and is highly recommended.

Ensure bales are wrapped correctly. Count the number of turns it takes to cover a bale, multiply by two and add one to ensure that the bale is covered with four layers of plastic. To cover the bale with six layers of plastic, multiply the number of wraps needed to cover the bale by three and add one.

Always make sure that there are no 'windows' on the bale where it is not completely covered with the correct number of layers of plastic. This happens when the plastic is stretched by more than 70% due to poor quality plastic or an incorrect setting of the pre-stretch unit on the wrapping machine. Determine the extent to which the plastic is stretched by drawing a 10cm line with a marker on the roll of plastic, turn the bale and measure the line on the bale again. If it is longer than 17cm, the plastic is stretched by more than 70%.

Transport the bales to the area where they are to be stored, turn them over and leave them on their heads where there are many more layers of plastic. Round bale silage cannot be stored for more than nine to 12 months and is therefore not suitable as a long-term fodder bank. Bales that are damaged should be removed as soon as possible.

5.6.6.6 Chop length

Maize plants should be chopped to a length of between 8 and 12mm. If the chop length is shorter than 8mm, it could lead to problems relating to effective fibre in the diet of the dairy cow. Chop lengths longer than 15mm can lead to problems with compaction and oxygen infiltration. The chop length of maize can be determined by measuring the stem sections.

As not all plant material passes through the cutter at the same angle one can expect longer pieces of plant material to always be present. Blades should be sharpened regularly to ensure a 'clean' cut. Dull blades lead to frayed material and poorer compaction. The drier the material, the finer it should be chopped to ensure good compaction.

5.6.6.7 Compaction

Well-compacted maize silage will weigh 750kg/m^3. Compaction time should be 1 to 3 min/tonne of wet material. One tractor should take 15 minutes to compact a 5-tonne load. One tractor cannot compact more than 60 tonnes of wet material/h effectively. Consider using a second tractor for compaction if the loads are coming in too quickly.

Chopped material should be spread out in a layer of 15 to 30cm and compacted. Make the tractor as heavy as possible by adding weights and filling the tyres with water. Single wheels compact more efficiently than double wheels.

5.6.6.8 Bunkers

Fill the bunker as soon as possible (within seven days) and seal it tightly with plastic. If the silage is to be stored for longer periods, place a layer of sand of about 5cm on top of the plastic. This will prevent the sun from damaging the plastic. Tyres that were cut lengthwise can be placed on top of the plastic. Never place straw or hay on top of the plastic, as this poses a fire hazard and creates an ideal environment for rats which will damage the plastic.

Ensure that water cannot enter the bunker and that the bunker can drain. When oxygen enters the bunker, yeasts and fungi begin to grow and the silage heats up during the decomposition process. Warm silage leads to reduced intake and milk production.

Silage should be removed from the bunker at a rate of at least 20cm/day, and the bunker should be planned accordingly. All loosened silage should be removed daily. Use block cutters so as not to disturb the face too much when removing silage.

5.6.6.9 Optimal preservation

Well-preserved silage has a light-yellow colour and a sweet, fruity, pleasant, sour smell. It will not contain any butyric acid which will give silage a bad smell. The DM content will be at least 30% and the pH will be 4,5 or lower.

The pH necessary for preservation depends on the DM content of the material and can be calculated as follows: pH = 0,00359 X DM(g/kg) + 3,44.

Well-preserved silage will lead to good intakes by sheep and cattle. When animals do not want to ingest silage, it is usually because of a high moisture content and bad smell. Silage should not become warm in the feed trough. Warm silage is an indication of yeasts and fungi actively growing. Increase the rate at which silage is removed from the bunker.

Ensure better silage compaction and seal the bunker sooner. Consider applying silage inoculants that improve the aerobic stability of silage. To ensure its effectiveness, inoculants should be applied with an applicator on the silage cutter.

5.6.6.10 Silobags

Unlike drive-over buns or bunkers, silage stored in silobags is not exposed to oxygen while being compacted. Furthermore, the last oxygen trapped in the bag is largely removed by the displacement of carbon dioxide (CO_2).

In terms of DM losses during primary fermentation, losses from the silobag system are much lower compared to bunkers and buns, thanks to the rapid and efficient removal of oxygen. This system also has no top losses.

As with all silage systems, preparing the ground beforehand is essential. In the case of silobags, this is even more important, as sharp stones or sticks can damage the plastic. Bags should ideally also be placed at a slight slope (from the bottom to the top).

Two key factors need to be managed once a bag is full: seal the front as soon as possible and pack it properly. It is also essential to cut a hole in the highest point of the bag, through which gas that builds up due to cellular respiration and fermentation can escape (oxygen is first displaced by CO_2, followed by the CO_2 itself).

Different silages produce different amounts of gas, and only once gas has stopped escaping through the hole can it be taped shut. Should a producer neglect to re-tape the hole, the silobag will likely lose its greatest advantage: a completely sealed, CO_2-containing anaerobic system. The bags should therefore be inspected daily for the first week or two.

Ensure good quality silage by following the basic principles of ensiling. Mistakes during the ensiling process cannot be corrected later. Cut the crop at the right stage, chop sufficiently, compact well, and keep air and water out by sealing the silage.

SOURCES
- Meeske, R. 2011. Maak beter kuilvoer.
- Venter, R. 2022. Silage storage forms (Part 3): Silobags.

5.7 PROBLEM PLANTS

One of the biggest obstacles to establishing good grazing and high carrying capacity is the presence of unpalatable and/or toxic plant species mixed with desirable species. Drought, improper grazing, or any other form of soil degradation can lead to the invasion of new problem plants and the promotion of species that have become established over time. The control and management of problem plants should be an integral part of pasture management.

5.7.1 Plants that present problems

From a livestock production perspective, problem plants include those species that are poisonous, otherwise harmful, unpalatable, or unproductive. Poisonous plants produce toxic compounds that cause problems when ingested. Other chemicals in plants can alter the taste of milk and meat. Seeds can impair the quality of wool and unpalatable plants can harm grazing and animal production. Non-productive plants, in turn, have low nutritional value. When they are widespread or exhibit the characteristics of an invasive plant, they can become a threat to the value of grazing and its carrying capacity.

Because there is often confusion and overlaps in the names used for classifying plants that are considered problematic or undesirable, we must first agree on the appropriate terminology. There have been many attempts to classify plants, based on problem status, economic impact and origin, into weeds, unwanted plants, noxious plants, problem plants, invasive plants, alien plants, naturalised plants, etc.

5.7.2 Definition of a weed

People tend to call any plant a weed when it conflicts with their economic or aesthetic expectations. People and plants come into conflict in the fields of plant and animal production, in gardens, recreational areas, sports fields, etc. There are many definitions of weeds, but they all have one thing in common: the definition is constructed from a human point of view, according to which all plants without noticeable value or utility can be considered weeds.

On the other hand, from a purely ecological point of view, this is an unfair classification of plants that may otherwise play an important role in nature. By definition, even the maize plant that jumps up in a soya bean field is a weed, as are indigenous plant species such as sickle bush and mopani when they cause bush encroachment.

Let's then agree to stick to the broad definition: A weed is an indigenous or alien (exotic) plant species that has a negative economic or ecological impact on agricultural or natural systems.

5.7.3 What the law says

According to the *Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983)*, problem plants are classified according to their harmful or poisonous status. In 2000, Regulations 15 and 16 of the *Act* were amended in respect of alien invasive plants and indigenous species associated with bush encroachment.

Regulation 15 provides for more than 200 alien species which are divided into three categories:

- **Category 1: Declared weeds.** These are prohibited plants that must be controlled or eradicated. These species have no economic value and possess characteristics that are harmful to humans, animals, and the environment.
- **Category 2: Declared alien invasive plants of value.** They have certain valuable characteristics, such as commercial value (e.g. tree species for forestry), animal feed, and soil stabilisation. They are permitted in demarcated areas from which their spreading must be prevented.
- **Category 3: Mostly ornamental plants.** These are alien plants found in gardens, or that have escaped from them (spread). No further planting is permitted, except with special permission. These plants may not be traded. The spread of existing plants must be prevented, as in the case of category 2 plants.

5.7.4 Grazing and toxic plants

In terms of Regulation 16 of the *Act*, some 68 tree species and 17 shrub species are classified as bush encroachers or densifiers. In addition, there are 12 indigenous grass species that are associated with veld degradation.

Overgrazing and selective grazing can reduce the number and variety of palatable plant species to such an extent that desirable species are eliminated in places, and their place is mostly taken by a few unpalatable or poisonous species. As a result, animals can no longer meet their nutritional needs by selecting from a variety of species. Plant poisoning is usually accidental and mostly occurs when grazing is scarce, such as during drought, after the main growing season, or after a veld fire when the risk of overgrazing and trampling of grazing is high.

Animals are not only harmed by directly ingesting weeds; weeds also compete with desirable plants and reduce pasture production. Stored fodder such as hay may be contaminated with the seeds and/or plant material of poisonous weeds.

In addition, fodder and animal manure are important means by which weeds can spread over long distances. During the Anglo-Boer War, several alien weed species which are still causing enormous damage to agriculture and nature today, entered South Africa from Argentina by way of fodder and horses obtained by the English forces for their war campaign in the country.

Plant poisoning of livestock and other animals and the other damage caused by these plants have been thoroughly documented by veterinarians and researchers in South Africa. The damage caused through plant poisoning is due to chemicals produced by poisonous plants as part of their strategy to deter herbivores. Deterrence usually works because the same chemicals make the plants unpalatable. Ingestion therefore often occurs accidentally or in emergency situations when few other plants are available.

5.7.5 Damage and losses

Poisoning damages the central nervous system, cardiovascular system, gastrointestinal tract, respiratory system, skin, and major organs such as the liver and kidneys. Poisoning has a significant impact on animal production, with total losses in the case of mortalities and reduced profit margins when weed control and treatment of animals are required.

Overgrazing by livestock and wild animals delays or prevents the re-establishment of indigenous perennial grasses. Livestock can be controlled by rotating grazing areas, but wild animals are naturally more

Latana (Lantana camara).

Gifblaar (Dichapetalum cymosum).

Silver-leaf nightshade (Satansbos) (Solanum elaeagnifolium).

difficult to control. The use of fencing and access control at watering places can be very valuable in controlling grazing pressure.

It is worthwhile monitoring weed control to determine the success of control methods, as well as for taking follow-up actions. The first step in managing weeds in cultivated and natural pastures is correct identification of the species. When identifying and applying control in natural veld, it is especially important to distinguish between weeds and indigenous species.

5.7.6 Effective control

For effective weed control, the best approach is one of integrated management, using the most appropriate combination of control methods. Reliance on a single weed control method does not offer long-term results, as weeds will adapt and become resistant to a particular control method over time. The broad groups of weed control methods are agronomic practices (in cultivated pastures), chemical with herbicides, biological with natural enemies, and mechanical.

Non-chemical methods include preventing seed dispersal in manure, control on boundary fences and surrounding areas, hoeing, cutting and pulling by hand. Although the majority of herbicides are safe for humans and animals, consideration should be given to possible abstention from grazing after treatment with certain herbicides. In cases where targeted spot treatment of plants with herbicides is possible, it is possible to effect considerable savings on products.

Sickle bush (Dichrostachys cinerea).

Rough cocklebur (kankerroos) (Xanthium strumarium).

Mesquite (Prosopis glandulosa).

The key to effective weed control in cultivated and natural pastures is to apply appropriate methods in a timely manner. The situation often becomes difficult to control when the producer waits too long before exercising control, especially if the cost of controlling the problem starts to exceed the value of the land. Judicious grazing management is essential for effectively controlling weeds to levels below that of an economic loss, in favour of desired plant species.

Ideal grazing management involves, among other things, recording the baseline status of the grazing, as it was before the serious weed infestation. Steps include correctly identifying desired plants and weeds, determining their grazing value, and the stage of grazing and its capacity to recover. This procedure will result in an appropriate, practically feasible management recommendation for restoring acceptable grazing capacity to a weed-infested area.

Inkberry.

5.7.7 Overview of harmful weeds

Existing lists containing categories of harmful weeds are far from complete. This list only provides an overview of the known problem plants.

- **Indigenous poisonous plants:** *Dichapetalum cymosum* (gifblaar) • *Lippia* species (*beukesbossie, laventelbos, lekkerruikbossie*) • *Senecio* species (Dan's cabbage, starvation senecio, etc.).
- **Exotic poisonous plants:** *Lantana camara* (lantana) • *Cestrum laevigatum* (inkberry) *Pteridium aquilinum* (brackenfern).
- **Indigenous bush encroachers:** *Dichrostachys cinerea* (sickle bush) *Colophospermum mopane* (mopani) • *Acacia mellifera* (blackthorn).
- **Foreign invasive plants:** *Chromolaena odorata* (triffid or paraffin weed) • *Solanum elaeagnifolium* (silver-leaf nightshade) • *Parthenium hysterophorus* (parthenium).
- **Decreaser grass types:** *Aristida species* (three-awn or *steekgras*) • *Tragus species* (carrot seed grass) • *Setaria pallide-fusca* (yellow foxtail).

SOURCE

- Reinhardt, C en Truter, W. Probleemplante vir vee en veeboere.

5.8 CLIMATE-SMART DROUGHT READINESS

Drought is a recurring phenomenon in the arid and semi-arid regions of Southern Africa. In fact, we are 100% certain that it will dry out at some point – we don't, however, know when. It is this uncertainty that makes producers believe that it is impossible to plan ahead for droughts. However, it is important for producers to be proactive and plan for the next drought.

In the past, when a well-managed, state-supported drought relief scheme was still in place, producers could afford not to plan for the consequences of droughts. However, now that they have to rely on their own initiatives and with global warming being an additional reality, those who do not plan properly may not survive the next drought financially.

Climate-smart livestock producers have learned to think differently about planning for future droughts, so that they can survive them with the smallest possible impact. Those who have done so continue to farm and even expand their operations.

5.8.1 A reactive approach

Prof Don H Wilhite, a former professor at the National Drought Mitigating Centre at the University of Nebraska, described the natural human attitude towards droughts as illogical behaviour that follows the hydrological or water cycle in nature, calling it the 'hydro-illogical behavioural cycle'.

This attitude and behaviour regarding drought are explained as follows: At some point or another, people become aware of a developing drought. If it rains on time during this period, the **awareness** disappears, and people usually move directly to that part of the cycle that is described as **apathy**. Everyone is relieved that the drought has not materialised and simply waits on the next scare.

However, if the rains do not come during the **awareness phase** and feed shortages worsen, they enter the **concern phase**. Financial pressures increase, roughage in the veld starts dwindling, the use of licks increases drastically, the condition and performance of the animals decrease, and water resources start coming under pressure. The press wakes up and increasingly more media outlets report on the drought.

As the drought drags on and becomes more intense, the **panic phase** is entered, and crisis management is the order of the day. Decisions are driven by emotion rather than good judgement. The symptoms of drought crisis management include emergency slaughter in the midst of already decreasing meat prices, higher than normal livestock losses (especially young stock), low occupancy of female animals, roughage shortages, and cashflow problems.

In the past, this panic phase was to a large extent alleviated by drought subsidies. This safety net still exists with most governments in Southern Africa, but it is generally so poorly administered that the aid either does not reach producers at all or reaches them too late.

When the rains finally break the drought, most of the effort goes into repairing the drought damage and the lessons learnt during the drought are quickly forgotten with people returning to the **apathy** phase.

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5.8.2 A proactive approach

The solution to the nature of the hydrological behavioural cycle is to think of droughts differently, namely proactively instead of reactively. In the hydro-logical cycle, proactive planning for the next drought is done during the good rainfall years (instead of waiting indifferently for the next drought). A series of long-term strategies, contingency plans and buffers are put in place to ensure that the farm will be better protected and less vulnerable during the next drought.

As soon as the next drought rears its head,a series of pre-planned contingency plans (short-term strategies) are systematically switched to instead of reverting to crisis management. These contingency plans take the emotion out of decisions and avert crisis management. Of course, this type of planning does not make farms completely drought-resistant, but it does reduce its impact.

The success of the hydro-logical behavioural cycle lies in the proactive planning done during the good times. Steps to better weather a drought should be in place before the drought commences. This reduces the scramble for solutions when the drought is already starting to bite.

The poorer one plans for the next drought, the greater its impact will be. Good planning offers significantly more options to better weather a drought.

5.8.3 Get ready for a drought

Preparing for the next drought means employing farming practices that will help reduce the farm's drought vulnerability, increase drought tolerance, and mitigate the effects of the drought. It does not mean escaping the drought. Practices that are profitable and will also ensure that the farm is geared for the next drought and has the necessary buffers in place to better survive it, are applied consistently and over the long term.

If this phase is not used to reduce vulnerability and increase tolerance, the producer will have limited options during the drought and the farm's resilience will come under great pressure.

The mitigation measures (or buffers) that a livestock producer can put in place during this phase include, among others, the following:

- Veld that is in good condition.
- Adapted livestock, production systems, and good herd composition.
- Building up a drought fodder bank or establishing an emergency fund to purchase drought feed.
- A sound financial position when the drought strikes.
- A reliable early warning system.

5.8.4 Veld that is drought resistant

One of the best insurance policies to hedge one's farm against drought is veld that is in good condition. The better the veld, the higher and more stable the forage production, the better its quality, the better the drought tolerance and endurance, and the more profitable the farming enterprise.

There are several reasons for this. Firstly, the poorer the veld's condition, the more rainwater will run off and end up in streams and rivers. As a result, soil moisture will be lower, even if good and poor veld receive the same amount of rain. The better the veld, the more rainwater will penetrate the soil and the higher its soil moisture content.

The poorer the veld, the greater the loss of topsoil and organic matter due to water and wind erosion. The topsoil of poor veld is also more compacted than that of good veld, thus contributing to poor water infiltration. In addition, poor veld soil

temperatures are higher than those of good veld, with associated higher evaporation and therefore a drier soil profile.

Good veld has a denser plant population than poor veld. The plants that dominate in good veld also convert soil water into feed production much more efficiently than those in poor veld. This is because the plants in poor veld are often mostly annuals. Their most important survival mechanism is to produce seeds. In times of drought, they therefore don't waste energy producing feed but rather produce seeds. The drier it gets, the greater this difference in feed production between good and poor veld.

Plants that dominate in poor veld also have a much lower protein content than plants dominating in good veld.

Finally, the incidence of pseudo-droughts tends to increase as the veld condition deteriorates. A pseudo-drought is the result of a shortage of grazing due to poor veld condition and not due to a lack of rainfall.

Veld in poor condition has mainly three drawbacks. It has less water in its soil profile, the plants on it produce less roughage, and the roughage is of poorer quality. In good and average rain years, the disadvantages of poor veld are not very obvious. It is only when it dries out that the difference becomes more noticeable.

To enjoy the protection of good veld during a drought, the good years must be utilised to get the veld in good condition. A drought is not the time to try and improve veld. By then it is too dry for meaningful veld improvement and producers won't have the finances it takes to make these improvements.

5.8.5 Buffers to bridge a drought

1 **Veld in good condition:** The better the condition of the veld, the higher and more stable its forage production, and the better its drought tolerance and endurance. The plants that dominate in good veld convert soil water into forage production more efficiently than those in poor veld, as plants in poor veld are often mainly annuals. Their main survival mechanism is to produce seed, and they therefore do not waste time on forage production. To enjoy the protection of good veld, the good years must be used to get the veld into good condition. A drought is not the time to try and improve veld.

2 **Farm adapted livestock:** Livestock that produce sub-optimally in good years will fail in years of drought. Therefore, animals that do not perform optimally in a good year should be identified and culled. A drought is not the time to go through this exercise. Select females that will conceive quickly, complete their pregnancy, and raise their offspring well. Place particular emphasis on animals that are dependent on minimal external help in terms of extra feed.

A herd or flock that is dependent on external help to produce optimally in good years will put immense pressure on the farm during a drought. Implement production systems that are in harmony with the natural resources on the farm. Synchronise the lambing and calving seasons with the natural feed availability patterns on the farm. Farm with a herd that is adapted to the natural resources on the farm.

3 **Build up a fodder bank:** A drought fodder bank is usually reserved for the core herd or flock only. Examples of a drought fodder bank are thornless prickly pear and agave. Old man's saltbush is often considered a drought fodder crop, but its production can be disappointing during a drought. Hay, crop residues, and silage should be stored in such a way that weather conditions do not compromise its quality. The amount of feed that needs to be stored will depend on the length of the

drought expected in an area, as well as the number of animals that need to be fed. A general rule is to store enough feed to supply your livestock for 180 days (six months).

4 **A healthy financial position:** A farm that experiences financial pressure during average and above-average rain years will not survive a drought financially. The farm's financial obligations (debt) must be of such a nature that these debts can be serviced, even in a drought year. The minimum requirement is for a farm to service at least the interest during a particularly intense and prolonged drought. Become a member of an economics study group or use the services of an accountant who can prepare complete management statements. This is the only way to determine whether the farm can perform well economically and financially.

5 **Early warning system:** Drought develops gradually and is difficult to detect early on. Drought has a way of catching you with your pants down. The earlier producers can become aware of a developing drought, the sooner they can switch to the defensive management tactics required during the drought phase. A reliable early warning system is therefore essential.

SOURCES

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6 ANIMAL HEALTH AND WELFARE

6.1 DISEASE OBSERVATION

South African livestock herds are an integral part of the African continent with its considerable number of infectious diseases. Livestock are plagued by various livestock diseases, some fatal and others less so. The Onderstepoort Veterinary Institute was established 117 years ago to find solutions to diseases that made it almost impossible to successfully farm livestock in South Africa.

The research conducted between 1910 and 1990 unravelled most disease causes in the country; for most of these diseases, successful treatment or prevention was found by way of vaccination. The research done there was pioneering work that received praise internationally.

The causes of animal diseases can be divided into five categories, namely injuries, poisoning, contamination, parasites, and feed/nutrition.

Livestock are naturally hardy and can, through proper exposure, build up resistance to many diseases. In most cases, immunisation is the most important step any livestock producer can take to protect his/her herd. In other instances, immunisation and treatment are not an option and large-scale mortalities are the ultimate outcome.

Fact is, more than 90% of livestock diseases or conditions can be prevented with an early detection system and/or preventive vaccination in place. A daily observation chart (*Figure 6.1*) offers a system that can be easily implemented by any producer and involves doing a number of basic checks so that abnormalities can be recognised immediately.

The daily observation system focusses on five basic observations: **The animal's head** (position – hanging or upright), the **body** (rumen fill, body condition, and condition of the skin/hair), **intake** (eating, drinking water, breathing), **movement** (legs, back, feet, lying position), and **excretion** (manure, urine, milk).

Figure 6.1: Daily observation chart. (Source: Veterinary Network)

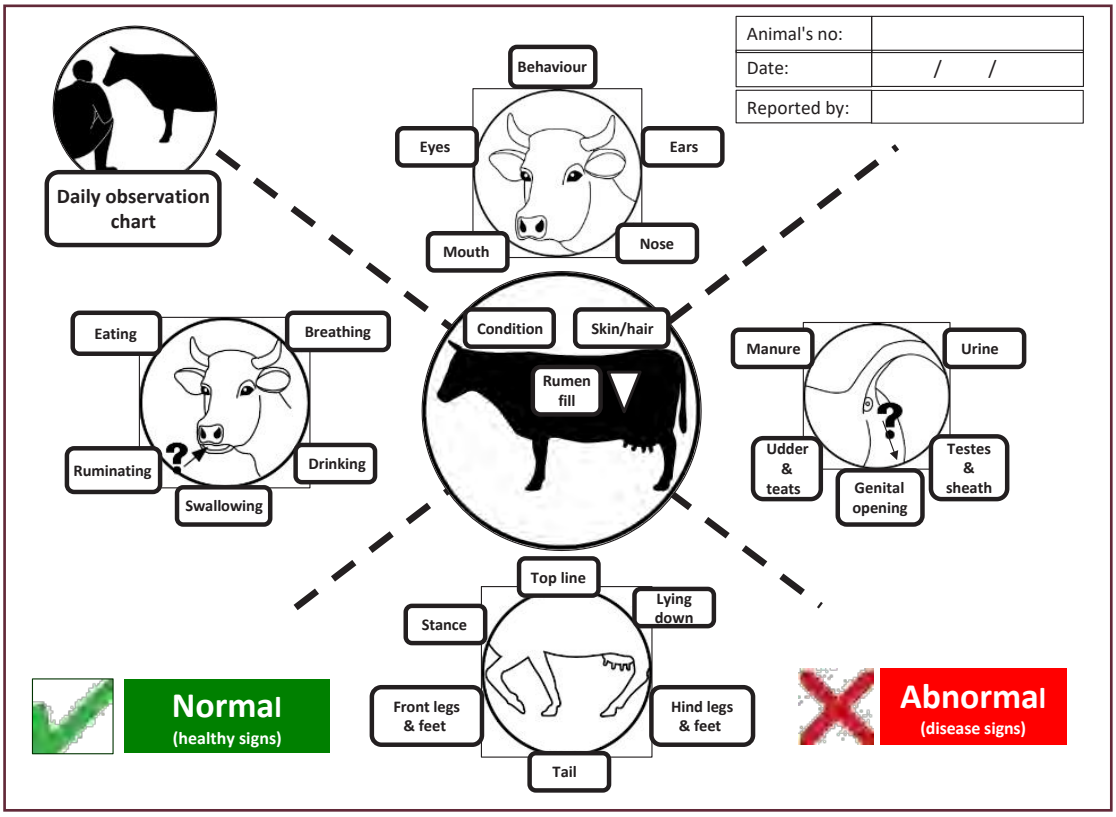
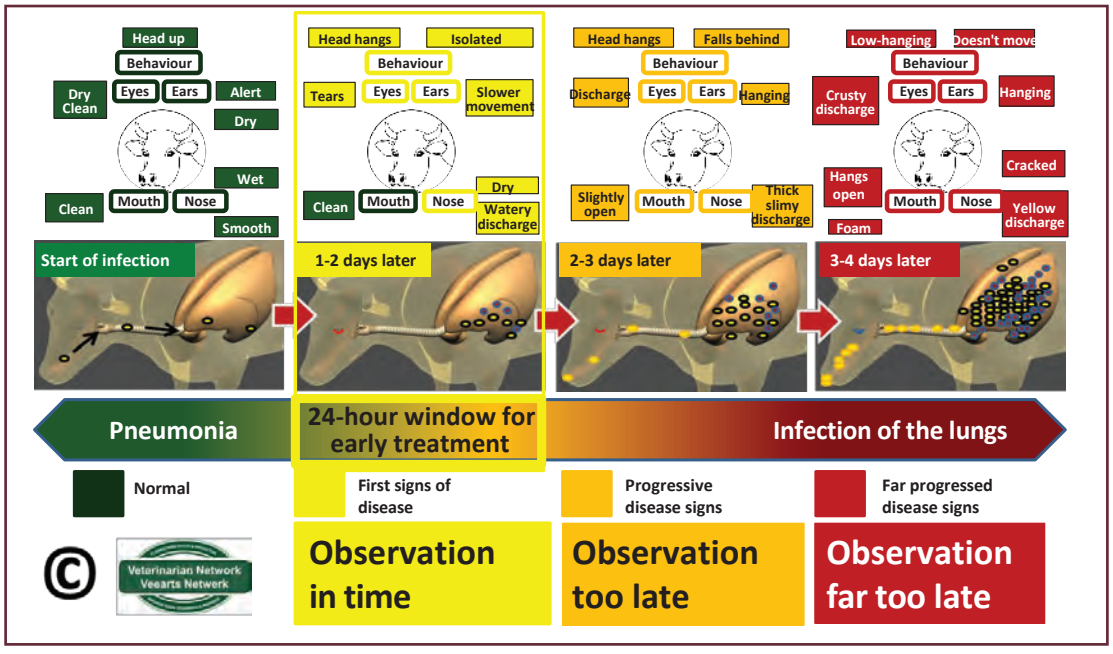


Figure 6.2: Signs of pneumonia the herdsman can see if a structured observation system is followed. (Source: Veterinarian Network)



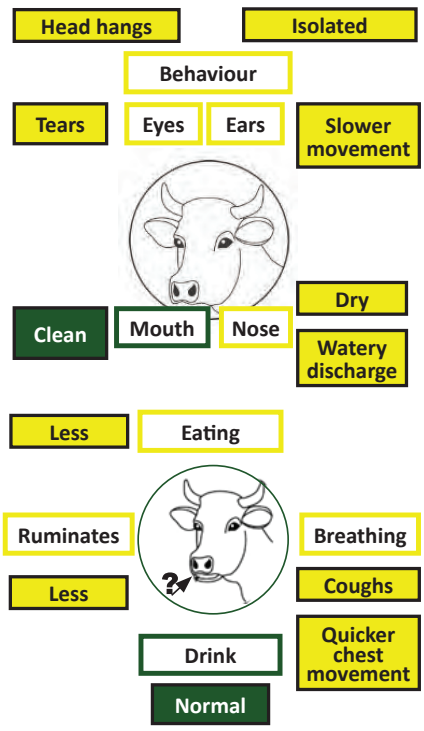
Should any abnormal signs be observed (disease signs), three further investigative steps should follow:

- Take the animal's temperature (anything above 40°C is a fever reaction and requires immediate action).
- Check the eyelid (a pale mucous membrane indicates blood loss) and inspect the head and neck for blood loss or other abnormalities.
- Do a physical examination of the animal's lymph nodes and the rest of the body.

Any abnormality should be recorded and, if necessary, reported to the herd veterinarian.

Figure 6.2 illustrates how the daily observation chart can be used to detect a disease such as pneumonia in time. *Figure 6.3* illustrates how early observation can affect the success rate of disease treatment.

Figure 6.3: Early observation of the first signs of pneumonia will determine treatment success. (Source: Veterinarian Network)



Should the first signs of disease be observed, the animal must be examined.

Should the animal's fever be above 40^{0}C, a systemic infection such as pneumonia is definitely present.

Consult the herd veterinarian if you are uncertain whether this is pneumonia or not.

If the animal receives timely treatment, it may be able to fully recover.

Should treatment commence too late, the lungs will be permanently affected, even if the animal survives. The other scenario is that the animal will not react positively to treatment, as the damage to the lungs will be too extensive and the animal will die.

SOURCES

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- Veterinarian Network documentation, 2025. Dr Danie Odendaal.

6.1.1 Condition scores in sheep and cattle

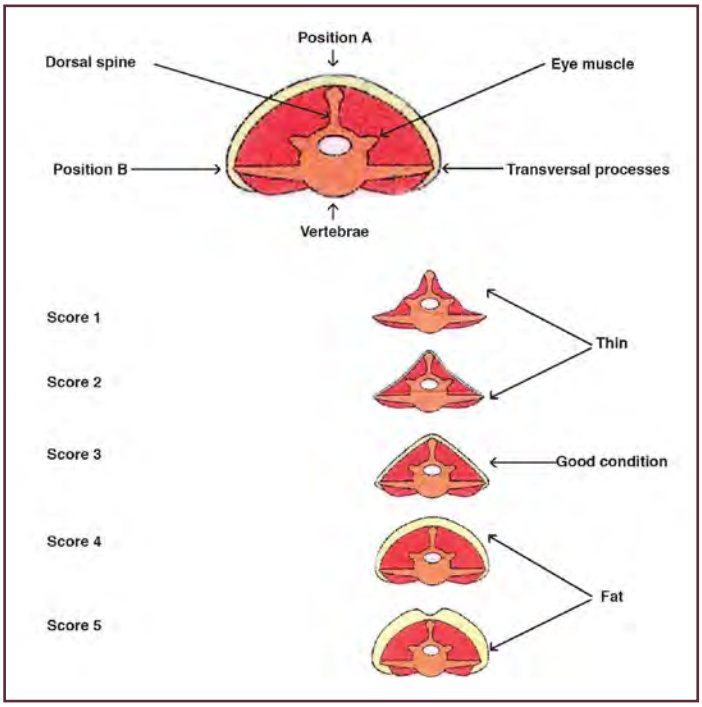
Body condition score remains one of the most important aspects driving aspects such as normal calving or lambing, milk production, reconception, and the like.

The scores on which condition scores in cattle are determined, work on a scale of poor to good and are set out in *Table 6.1*. Body condition scoring of sheep can be done according to the chart in *Figure 6.4*. The latter involves palpating the loin area with your hands. The extent to which the backbone, eye muscle and fat cover can be felt, will determine the condition score.

Table 6.1: Body condition score in cattle.

Poor	Transition			Good
2	2,3	2,5	2,7	3
Negative energy balance	- Loin area		+	Positive energy balance
				
Eye muscle is very indented, but the end of the bone feels only very slightly rounded.	The eye muscle is half full and the bone end feels rounded.			The eye muscle is full, and the bone end is only just detectable when pressing on it.

Figure 6.4: Condition scoring in sheep.



SOURCES

- ZZ2 protocol, 2025. Dr Danie Odendaal.
- *Guidelines for livestock farming*, 2015. NWGA and RPO.

6.2 NOTIFIABLE AND CONTROLLED DISEASES

The *Animal Diseases Act, 1984 (Act 35 of 1984)* was established with the aim of protecting the producer, his neighbours, and consumers of animal products.

Controlled animal diseases are any animal disease for which general or specific control measures are prescribed by legislation. This includes any animal disease that is not indigenous to or naturally occurring in South Africa.

Certain criteria were established by the state to identify controlled animal diseases. Animal diseases that meet at least three of the following five criteria are classified as controlled diseases and in these cases the state must intervene to protect role-players:

- **Zoonoses:** Animal diseases that can also be transmitted to humans.
- **Rapid spread:** Diseases that spread rapidly within a herd and across farm boundaries.
- **Collective control:** The disease is better managed by a collective control strategy than through the efforts of an individual livestock owner.
- **Threat to the sector:** The disease poses a serious threat to the performance of the agricultural industry if its current epidemiological and geographical distribution were to change.
- **Trade sensitive:** The disease can be considered a trade sensitive issue and poses a potential threat to South Africa's international trade status.

Legislation contains a list of approximately 40 controlled diseases for which control measures are prescribed. Some of the best-known diseases include foot-and-mouth disease (FMD), bovine brucellosis, anthrax, African horse sickness, tuberculosis, and rabies.

Notifiable animal diseases, on the other hand, are animal diseases for which no specific control measures are prescribed, but which must nevertheless be reported to the local state veterinarian. Notifiable animal diseases include *snotsiekte* (bovine malignant catarrhal fever), bluetongue, lumpy skin disease, Rift Valley fever, and strangles in horses and donkeys.

Reporting animal diseases

The landowner or farm manager is legally obligated to take all steps to prevent the spread of notifiable or controlled animal diseases. Any case of or suspicion that an animal is infected with a controlled or notifiable animal disease must be reported to the state veterinarian.

Blood or tissue samples from sick animals will then be taken, correctly packaged, and sent for analysis to a laboratory approved by the director of the Directorate of Animal Health. Furthermore, infected or suspected infected animals must be isolated and immediate steps must be taken to prevent the disease from spreading further. Effective biosecurity must be implemented on the farm.

Landowners or farm managers who fail to report controlled or notifiable animal diseases may be found guilty of an offence and fined or imprisoned for up to two years. They may also be held liable in terms of Section 34 of *Act 35* for any act or omission of an employee or member of their family.

Duties of the state

According to *Act 35*, the director of animal health may give written notice to the landowner that he/she will take control of the farm for a specified period. After issuing this notice, he/she is also permitted to enter the farm, remove vegetation, and erect fences in an attempt to control the spread of disease.

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Alternatively, the director may, without any prior notice, enter the farm in search of infected animals, seize infected animals, and order that these animals be treated or slaughtered. In cases where the director orders that animals be slaughtered, the producer is entitled to compensation.

Compensation for culling

In the 2008 case of *The Minister of Agriculture vs Bluelilliebush Dairy Farming (Pty) Ltd*, the Court of Appeal ruled that the state had to pay out more than R10 million for 7 000 cattle that were culled in the Eastern Cape to prevent the spread of tuberculosis.

The claim was based on Section 19 of *Act 35*, read with *Regulation 30*, which provides that where infected animals are culled, a producer can claim 80% of the fair market value of the animal and that where uninfected animals are slaughtered, the producer can claim 100% of the fair market value.

Regulation 30 was subsequently amended and currently provides that the director must decide on 'appropriate compensation' when animals are slaughtered upon his/her order.

An animal disease outbreak in a herd can result in major losses but can also harm fellow producers. It is therefore essential that producers comply with the provisions of *Act 35*. Consult with your local veterinarian and/or a lawyer to ensure that you operate within the framework of this law.

6.3 DEADLY BACTERIAL DISEASES

6.3.1 Clostridial diseases

Status: Proof of vaccination when purchasing an animal.

Species affected: Cattle, sheep, and goats.

Causes and spread: Spongiform encephalopathy (*Clostridium chauvoe*i); clostridial disease (*Clostridium novyi* type A); malignant oedema (*Clostridium septicum*); sudden death (*Clostridium sordellii*); red gut (*Clostridium perfringens* type A); pulpy kidney (*Clostridium perfringens* type D). Animals can ingest the bacteria or even the toxins they produce along with grazing or feed or become infected through exposure to open wounds. Some bacteria live comfortably in the intestines without causing any clinical signs, until the animal's immunity is weakened to such an extent that the bacteria start multiplying rapidly and produce excess toxins that affect all the organs.

Prevalence: Countrywide, with the bacteria being omnipresent in nature (soil). Stressful conditions such as intensive feeding systems, mixing of groups, weather conditions, deworming and handling can lead to an increase in clostridial disease occurrence. Environmental conditions such as drought and floods can also contribute. Swollen head (*dikkop*) is more common in rams that fight and sustain open head wounds which serve as breeding grounds for bacteria.

Disease signs

- **Malignant oedema:** Watery accumulation under the skin. Strong rotten smell.
- **Blackquarter:** Swollen large muscle groups, air bubbles under the skin and between muscles, excessively bloody muscle tissue that may appear dark purple to black.
- **Swollen head:** Swelling of the forehead, around the eyes and later the throat area. Loss of appetite. Animal lies down and usually dies within a few days. Post-mortem examination: Clear, straw-coloured fluid accumulation under skin, fluid in chest cavity, around heart sac and in lungs.
- **Redgut:** Caused by *Clostridium perfringens* type A. Usually only problematic where animals are given supplementary feed or complete rations, and the organs grow too big and produce aflatoxin which causes damage and death.

Treatment: Animals usually die without any time for treatment (often overnight). The course of the disease is too rapid for immunity to develop. Antibiotics can help if administered in the initial stages of infection.

Prevention: Vaccination helps with building good protective immunity – a primary vaccination, followed by a booster and then annual vaccination. All vaccines against *Clostridium* spp. are inactivated. Some vaccines contain only one or two antigens, while multiclostridial vaccines contain up to ten antigens. Also consider additional management measures, for example where small stock is running on well-established pastures, or where the adaptation period for feedlot animals has occurred too quickly. The provision of good quality hay can help to limit a sudden increase in *Clostridium* pathogens.

Important notes: Livestock must be vaccinated against these diseases within the last six months prior to sale, and proof of vaccination must be provided (date, product, and lot number).

6.3.2 Botulism

Status: Proof of vaccination when animal is sold.

Species affected: Large and small stock.

Causes and spread: *Clostridium botulinum*. The botulism organism grows and multiplies on animal carcasses or any other decaying protein-rich material, such as wet lucerne bales, and produces a toxin. Animals ingest the toxin when they eat the decaying feed or chew on a bone from such a carcass. In many instances they will drink water from a water source in which a carcass lies. The toxin is absorbed from the intestinal tract into the blood and travels specifically to the nerve synapses and endings, where it binds irreversibly. The toxins block the transmission of nerve impulses, resulting in paralysis of the animal.

Prevalence: Countrywide.

Disease signs: Early symptoms include weakness in the hindquarters. The animal will eventually lie down and have no muscle tone in the tail. The tongue will also lose its muscle tone resulting in the animal being unable to feed and eventually dying. The diaphragm also stops functioning for breathing.

Treatment: Once the toxin has irreversibly bound to the nerve endings, no treatment is possible. The animal becomes paralysed and dies within a few days.

Prevention: Annual vaccination with the inactivated vaccine. In the case of young animals, or animals receiving the vaccine for the first time, the first vaccination should be followed within six to eight weeks with a booster dose, as is applicable to most inactivated vaccines. This is done so that the antibodies in the animal's bloodstream can reach elevated levels. Whereas in the past producers vaccinated animals with a basic vaccine against botulism and blackquarter, they now have access to some broad-spectrum vaccines that include botulism.

Important notes: Good management can help to some extent in preventing botulism. The toxin is found especially in chicken manure and there have been cases where hundreds of feedlot animals have died because they were fed chicken manure. Ensure that feed is fresh and dry, and that water sources do not contain rotting carcasses.

6.3.3 Pneumonia

Status: Proof of vaccination prior to selling the animal.

Species affected: All cattle breeds, sheep, and goats.

Causes and spread: Viruses that cause infectious bovine rhinotracheitis (IBR), bovine viral diarrhoea (BVD), and parainfluenza type 3 (PI3) weaken and paralyse the animal's natural defence mechanism in the trachea. This paves the way for *Mannheimia haemolytica* bacteria to move unhindered into the lower respiratory tract, where they become pathogenic. When they reach the lungs and become pathogenic, they release a leukotoxin that weakens and destroys the animal's alveolar white blood cells, which protect the lungs from pathogens. This leads to an increase in *M. haemolytica* in the lungs. If an infection is left untreated too long, it can lead to death due to respiratory distress.

External factors that can make cattle more susceptible to this infection include the presence of harmful gases such as ammonia and carbon monoxide, dust, a high-carbohydrate diet without prior adaptation, vaccination against respiratory diseases when animals are already sick, and stress factors such as weaning shock, transport, surgical procedures, exhaustion, limited space, mixing of animals from different farms, temperature fluctuations, and the like.

Prevalence: Throughout the year in most parts of the country, with an increase in numbers during the transitional months (autumn to winter and winter to spring).

Disease signs: Usually a clear discharge from the nose and eyes (which later becomes purulent), depression and lethargy, fever, loss of appetite, animals that appear stiff or sore when walking, rapid, shallow breathing, and a mild cough. However, these symptoms are not unique to *Mannheimia* infections and should therefore be confirmed by a veterinarian through diagnostic tests.

Treatment: *Mannheimia* infections can be treated with antibiotics and anti-inflammatory drugs, along with the administration of vitamin C and a bronchodilator. However, studies show that *M. haemolytica* may be resistant to penicillin, tetracycline, sulphates, and tilmicosin. Also try to limit the external factors that make animals more susceptible (see 'Causes and spread').

Prevention: The vaccine should ideally be administered two to three weeks before animals are transported. A booster dose can be administered once they have been unloaded. The vaccine, which specifically targets *M. haemolytica*, will activate antibodies against, among others, the leukotoxin released by *M. haemolytica*. A vaccine against respiratory disease complex is also available.

6.3.4 Anthrax

Status: Controlled disease.

Species affected: Livestock, game, pigs, pets, people.

Causes and spread: The bacterium *Bacillus anthracis* develops from hardened spores able to survive in nature for up to a century and which can withstand high temperatures of up to 100°C for short periods (five minutes). Animals contract anthrax when they ingest infected plant material, water, or even the bones of dead animals. Carcasses of animals that died of anthrax should not be cut open, as the spores are formed once the bacteria are exposed to oxygen. The decomposition of the carcass inside the intact skin builds up carbon dioxide gas that can destroy the bacteria. If the carcass is burned, spores can be released into the air and spread. A farm should be considered permanently infected if anthrax has occurred there.

Prevalence: Anthrax outbreaks usually occur during the winter and dry season in the Bushveld and Lowveld, whereas in the Northern Cape it occurs more frequently in the late summer months.

Disease signs: Typical symptoms, especially in cattle, include a lack of appetite, disorientation, falling over, and bloody diarrhoea. The most common sign of illness is swelling of the throat and neck. Animals have difficulty breathing and lie down frequently. Sometimes dark, black blood will flow from the anus and nasal cavities. Widespread bleeding, swelling, and tissue necrosis.

Treatment: None. Animals succumb very quickly (sometimes within two hours) and often before any symptoms are visible.

Prevention: Producers are legally obligated to immunise their animals annually. Young animals must be vaccinated between the ages of three and six months (primary vaccination) and annually thereafter. The anthrax vaccine is a live vaccine and can be administered on the same day as two other inactivated vaccines such as botulism and blackquarter. A combination vaccine consisting of anthrax (live Sterne strain), blackquarter and botulism toxoid (the latter containing two inactivated components) can also be used. Nowadays, the combined vaccine can include even more diseases and can also be administered to pregnant animals.

Important notes: Anthrax is a zoonosis, and people can contract it by working with infected animals or animal products, or by eating infected meat from animals that have died from the disease. People can also inhale dormant bacteria spores. The most common sign of anthrax in people is a skin rash – an itchy blister that forms, bursts, and leaves a black spot surrounded by a red sore. If left untreated, the infection can spread systemically. Nowadays, timely treatment of people infected with the bacteria is very effective.

6.4 INSECTBORNE DISEASES

6.4.1 Bluetongue

Status: Notifiable disease.

Species affected: Sheep – indigenous breeds are less susceptible than European breeds. Cattle and indigenous goats are susceptible but rarely get sick. Exotic goats and alpacas are highly susceptible.

Causes and spread: Viral disease (genus *Orbivirus*) transmitted by insects, specifically blood-sucking midges (mostly of the *Culicoides* genus).

Prevalence: Countrywide. Summer and autumn, especially after good summer rains.

Disease signs:
- Fever with a temperature above 40°C.
- Visible signs include a swollen face and even ears.
- The animal's skin may be red, and typical signs are seen around the hooves where a clear red line appears on the coronary band or heels.
- The most severe and painful lesions are usually in the mouth, gums, and on the tongue. The tongue can sometimes be very swollen, becoming thick and blue due to poor blood supply – hence the name, bluetongue.
- A break in the wool and hooves (coronitis) can occur and after three to four months the animal can lose its fleece entirely. Sometimes the hooves also come off.
- Muscle tissue is also affected, resulting in severe weight loss and sometimes causing a twisted neck (torticollis).

Treatment: Symptomatic. Antibiotic injections to prevent secondary bacterial infection of lesions caused by the virus. Inject anti-inflammatories for pain and inflammation. Available on prescription from a veterinarian. Softly ground feed and fresh water are important. Keep sick animals in the shade.

Prevention: Early vaccination of young sheep (six months old) before the rainy season, with the live attenuated vaccine (all three fractions should be administered at three-week intervals) or with the inactivated bluetongue vaccine. A booster vaccination of the inactivated vaccine is especially important. Follow the annual vaccination programme for adult animals at the start of the rainy season and administer a booster vaccination three to four weeks later when using the inactivated vaccine.

Important notes: There are more than 21 bluetongue strains (serotypes). The live vaccine (2025) contains only 15 strains in three fractions. The inactivated vaccine contains 11 strains. New serotypes are constantly being discovered. Animals develop immunity to the strains they are exposed to or vaccinated against.

6.4.2 Three-day stiffsickness

Species affected: Beef and dairy cattle.

Causes and spread: A virus transmitted by biting insects such as mosquitoes and midges.

Prevalence: Outbreaks are closely associated with environmental conditions in which high numbers of biting insects occur. Occurs annually, mainly in high rainfall areas, and to a lesser extent in the drier areas of the country. Large outbreaks can occur if above-normal rainfall is received in traditionally drier areas as there is less herd immunity. Three-day stiffsickness occurs three to four months earlier in the winter rainfall areas, as it coincides with wet and warm conditions in spring and early summer.

Disease signs: Must be distinguished from diseases that require immediate and correct treatment, such as redwater, anaplasmosis, and heartwater. Sick animals have a high fever, appear lethargic, lose their appetite, and isolate themselves. Animal is stiff and does not want to or cannot walk due to high levels of inflammation and pain in the joints and muscles. Will often lie down and not get up again, especially heavy bulls. Symptoms usually last only a few days after which the animal quickly recovers – hence the name, three-day stiffsickness. However, a state of disease develops when the virus specifically targets the cells that form the lining of the small blood vessels, leading to a decrease in the body's free calcium levels.

Treatment: No primary treatment is available. Symptomatic treatment includes administration of anti-inflammatories and calcium to manage pain and inflammation. Antibiotic treatment is recommended to prevent secondary bacterial infection, especially in the lungs. Food and water should be provided.

Prevention: Only through vaccination. Heifers, and young and stud bulls can be vaccinated at the start of the wet season. Dairy cattle, feedlot animals and valuable breeding animals can also be immunised. The first vaccination, especially in young cattle, should be followed up with a booster dose a month later. First vaccinations should be administered just before or during the start of the rainy season, and the booster dose as soon as the first disease cases are recorded in the district. Effective vaccines are available but should be administered according to the herd veterinarian's advice. Animals can also be protected with insect repellents such as a water-soluble spray or pour-on that provides protection against flies and biting insects.

Important notes: This disease has serious implications for reproduction and milk production in livestock.

6.4.3 Lumpy skin disease

Status: Notifiable disease.

Species affected: Cattle.

Causes and spread: Viral disease (*Capripoxvirus*) caused by insects (probably biting flies) and to a lesser extent by ticks. The disease is not spread from one animal to another.

Prevalence: Late summer and early autumn.

Disease signs: Noticeable skin lesions (especially prominent on short-haired cattle), observed as lumps in and beneath the skin. High fever, difficulty walking, slow movement, and loss of appetite. **Moderate cases:** Skin lumps will shrink once the cattle have developed immunity to the virus. **Severe cases:** Lumps may burst, and secondary bacterial infection can cause severe skin lesions. Internal damage to mucous membranes. The fever reaction and damage to the mucous membranes of internal organs can lead to pneumonia, abortions, and bull infertility.

Treatment: No primary treatment. All treatments are merely supportive until the animal develops own immunity to combat the virus. All infected animals must be isolated.

Prevention: Vaccinate young animals older than six months and vaccinate adult animals annually. Vaccinate before the insect population increases. It is too late to vaccinate and protect animals that have already contracted the disease. In the event of an active outbreak, poor needle hygiene can also spread the disease. Pregnant cows can be vaccinated, and the calves of immunised cows can be vaccinated from age six months.

Important notes: Dairy cattle are generally more severely affected than beef cattle and production losses can be as high as 50%.

6.4.4 Rift Valley fever

Status: Notifiable disease.

Species affected: Sheep, goats, cattle, buffalo, and camels. Sheep are more susceptible than cattle or goats, and younger animals are more likely to die from it than older animals.

Causes and spread: Virus spread by the *Aedes* and *Culex* mosquito species.

Prevalence: Late summer, early autumn, especially after exceptionally heavy showers and floods.

Disease signs:

- Very young lambs and kids are highly susceptible and exhibit high fever and loss of appetite, with mortalities occurring within a few days.
- Mature sheep have a high fever, are lethargic, breathe rapidly, and have foul-smelling diarrhoea containing blood.
- The most obvious sign of disease in pregnant ewes and cows is an abortion storm.
- The clinical signs in goats are not as severe as in sheep.
- In calves, mild clinical signs occur and between 10 and 15% could succumb.

Treatment: Viral disease for which no treatment exists. Preventive measures during an outbreak include moving animals from low-lying, wetter areas to higher elevations. Consider treating animals with a dip registered for biting and/or flying insects.

Prevention: Vaccination is the only means of prevention. The live Rift Valley fever vaccine can be administered to non-pregnant ewes and cows but is not suitable for pregnant animals. The inactivated Rift Valley fever vaccine for sheep and cattle must be repeated annually. It is especially important to vaccinate all replacement heifers and ewes with the live attenuated vaccine before their first breeding season. This vaccination forms the basis of preventing Rift Valley fever.

Important notes: Rift Valley fever is a viral zoonosis that can also be transmitted to humans through contact with sick animals or fresh carcasses infected with the virus. The virus cannot be transmitted from one person to another. Humans experience flu-like symptoms while other complications include blindness, meningitis, and severe bleeding. Outbreaks result in major economic losses for livestock producers and up to 95% of lambs younger than two weeks can die.

6.5 DISEASES THAT AFFECT REPRODUCTION

6.5.1 Bovine viral diarrhoea (BVD)

Species affected: A so-called erosion disease that mostly affects cattle, although sheep, pigs, and game can also be carriers.

Causes and spread: Virus transmitted between animals in several ways, including through blood, saliva, amniotic fluid, afterbirths, and syringes, as well as droplet infection. It can also pass from the cow to the calf through the placenta. The calf will then be permanently infected and unable to build up any resistance to the disease. It will continuously excrete the virus and infect other animals.

Prevalence: Countrywide.

Disease signs: Important clinical signs indicating that testing for the BVD virus should be performed include increased incidence of diarrhoea, especially in young animals, early embryonic death and foetal absorption, premature or stillborn calves, abortions and retained afterbirths, abnormal calves, respiratory tract infections and pneumonia, secondary disease conditions not usually seen on the farm, and increased somatic cell counts in dairies.

Treatment: None.

Prevention: The choice of vaccine is important. Pregnant animals vaccinated with a live vaccine may abort. Therefore, use vaccines that provide foetal protection when vaccinating female animals. Animals should be vaccinated at least one month before the start of the breeding season. Before vaccination, all animals must receive injectable trace minerals to enhance their immune response to the vaccine. Apply good biosecurity measures and insist on evidence that newly purchased animals have been tested and vaccinated.

Important notes: BVD is an erosion disease leading to the suppression or weakening of an animal's immunity, which makes the animal susceptible to various other disease conditions. This is also why secondary disease conditions are diagnosed while the primary virus involvement is often overlooked.

6.5.2 Infectious bovine rhinotracheitis (IBR)

Species affected: Cattle.

Causes and spread: Bovine herpesvirus type 1 (BHV-1) is a respiratory virus that, along with other organisms, causes severe pneumonia. Highly contagious and can affect the entire herd.

Prevalence: Mainly in feedlots and calf-rearing systems across the country.

Disease signs: Animals are often sick for several days before the first clinical signs of pneumonia are noticed. The most common symptom is a clear nasal discharge resembling a cold but leading to secondary bacterial pneumonia. Ulcerations can present in the nose and mouth, and can be confused with FMD. Other symptoms are dull corneas in the eye (the eyes appear pale), abortions in breeding animals, and pizzle infection in bulls. Cows can abort without any prior signs of disease. In feedlots, a decrease in appetite is also an important symptom.

Treatment: Treatment is usually impractical. Antibiotics will have no effect on the virus itself but can help to prevent and treat secondary bacterial infections. Anti-inflammatory drugs may be considered for painful ulcerations in the animal's mouth and nose. Where inflammation of the animal's brain occurs, the animal should be euthanised as the damage is irreversible.

Prevention: Young animals can be vaccinated with a live vaccine, at least twice before mating. Adult, producing animals can then be safely vaccinated once a year with an inactivated vaccine. Calves can also be vaccinated four weeks prior to weaning.

6.5.3 Bovine brucellosis

Status: Controlled disease.

Species affected: Beef and dairy cattle.

Causes and spread: The *Brucella abortus* bacterium. Direct transmission occurs from an infected animal to susceptible cattle through excretions, especially during abortion, in afterbirth, and amniotic fluid. Susceptible cattle mostly ingest the organism orally (licking contaminated material) but can also inhale it through the respiratory tract and contract it through the mucous membranes such as those of the eye.

Prevalence: Countrywide on cattle farms.

Disease signs:

- Abortions are the only sign.
- One exception is cattle that have been infected for a very long time and sometimes exhibit thickening of the joints (hygroma of mostly the knee joint in the front legs).
- Cows that have aborted once will mostly calve normally afterwards but continue to excrete the organism in the afterbirth and amniotic fluid.

Treatment: There is no practical or cost-effective treatment for cattle already infected with brucellosis or that are permanent carriers.

Prevention: Vaccinate heifers with the S19 brucella vaccine from four months of age and before eight months. Correct timing is important because heifers must be vaccinated before they reach sexual maturity. The syringe used for vaccination may not be used for any other purpose. In herds at high risk of bovine brucellosis, heifers and non-pregnant cows can also receive an RB51 booster vaccine which increases protection against the disease to over 85%. The vaccine only protects 85 to 90% of female animals against infection but prevents almost 100% of abortions which are the main transmission route of the disease.

Important notes: Brucellosis is a zoonosis that can be transmitted to humans when they come into contact with infected animals or animal products such as an aborted foetus or unpasteurised milk. After infection, cattle remain lifelong disease carriers. The only way to identify infected (carrier) animals is testing the blood for the presence of disease antibodies. Such animals must be culled in order to rid the herd of bovine brucellosis.

Protection against Enzootic Abortion in Sheep

CEVAC® CHLAMYDIA

LIVE VACCINE

3 Reasons to include Cevac® Chlamydia in the live vaccine protocol — From after weaning and selection of replacement ewes until 2 months before first mating:

1. **ECONOMICAL:** Only administered **once** in the ewe's lifetime as opposed to inactivated vaccines that require a booster plus annual revaccination
2. **EFFECTIVE:** Compared to inactivated vaccines, live vaccines confer an immediate, stronger and longer lasting cellular immunity, proven to withstand a challenge
3. **SHEEP WELFARE:** No painful injection site lesions

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6.5.4 Enzootic abortion

Species affected: Small ruminants, especially sheep.

Causes and spread: Bacterial disease caused by *Chlamydia abortus*.

Prevalence: Occurs countrywide in sheep flocks. The origin of the disease has never been determined with certainty.

Disease signs: Abortion storms (abortions or stillbirths), weak lambs or calves.

Treatment: Antibiotics, especially oxytetracycline, are often used to reduce the incidence of abortions, especially during outbreaks. However, antibiotics only have an effect on *C. abortus* when the latter is at a certain stage of its life cycle. Even then, antibiotics offer only limited control of the infection.

Prevention: Only through vaccination and good biosecurity. Adapted live vaccines with good efficacy are traditionally used but cannot be administered to pregnant animals. Inactivated vaccines are safe, even in pregnant or lactating ewes, and involve a simpler protocol. A good biosecurity protocol requires that infected ewes are identified and isolated, especially after abortions. Aborted foetuses, placentas, and contaminated bedding should be removed and destroyed. Disinfect pens and, where possible, leave them unused for about a week.

Important notes: In addition to lamb mortalities, affected ewes will remain unproductive which puts the farm under even more financial pressure. Outbreaks in young flocks lead to abortion storms with abortion rates of 30% or higher.

6.5.5 Trichomoniasis

Species affected: Cattle.

Causes and spread: Endemic disease caused by the protozoan *Tritrichomonas foetus*, which parasitises the mucous membranes of the reproductive organs. Transmission only occurs when an infected bull mates with a cow/heifer in standing heat.

Prevalence: Worldwide, trichomoniasis is the most common sexually transmitted disease in extensive cattle systems using natural mating. It South Africa, it occurs mainly in the central part of the country which corresponds to the areas with large commercial beef cattle herds. Bulls of all breeds are susceptible, and permanently infected bulls are the main source of infection. Bulls younger than four years can overcome an infection to some extent, but in older bulls the infection is usually lifelong and without visible clinical signs. These older bulls are the main carriers of the disease.

Disease signs: The organism grows on the lining of the uterus and has a negative effect on embryo implantation as well as early death and resorption of the foetus. It can also lead to abortions during late pregnancy. Cows that have contracted the infection and developed immunity can sometimes 'cleanse' themselves and become pregnant again after foetal loss. In a smaller percentage, the foetus is not completely resorbed which can lead to pyometra (pus accumulation in the uterus). Should abortions exceed the 2% level or if sudden abortions occur, an investigation should be done to rule out trichomoniasis.

Treatment: None. Good management is the only means of prevention. Where the infection is present in a herd, an eradication plan must be drawn up in conjunction with a veterinarian and implemented continuously until the herd tests free of the disease after a year or two.

Prevention: Bulls must be tested annually by the veterinarian before the breeding season commences. Testing can be done biennially in a closed herd with a high pregnancy rate. Artificial insemination can be used to limit transmission, provided the semen comes from bulls that do not have the disease. A vaccine containing inactivated *T. foetus* organisms is available.

Important notes: Good management practices are crucial. Maintain boundary fences and cull fence-jumping bulls and cows. Only buy clean, tested bulls with a breeding soundness certificate issued by a veterinarian. Retest bulls before use and quarantine any bull that had left the farm and returned, until it has been tested and found to be clean. Quarantine and test new animals. Test for trichomoniasis before collecting semen and consider applying a limited breeding season of a maximum of three months.

6.5.6 Pizzle rot (infectious balanoposthitis)

Species affected: Sheep and Angora goats.

Causes and spread: Various organisms are involved, two of which are *Mycoplasma mycoides* and *Corynebacterium renale*. It is highly infectious and transmitted mainly mechanically when infected rams cover ewes.

Prevalence: Across South Africa.

Disease signs: The disease manifests as small grey blisters that form on the ram's penis and the ewe's vulva, which later burst open and cause dark red, open sores. The first signs are a bloody discharge around the opening of the sheath and vulva. Secondary infections can cause great damage in rams, causing the penis to swell and deform so that it cannot enter the vagina. It is painful and makes rams reluctant to mate, which has a major impact on a flock's lambing percentage. In ewes, the lesions usually only occur on the vulva and almost never the vagina. Affected rams and ewes should be separated from the flock and treated immediately.

Treatment: Infection should preferably be identified early to minimise chronic damage that could impede future breeding. Can be successfully treated with antibiotics. Once affected rams have been isolated, injectable antibiotics can be administered to affected areas. A long-acting antibiotic can also be administered. Rams should not be used for breeding purposes until all the sores have healed. Pizzle rot has no direct effect on the fertility of ewes, and they usually recover on their own within a few weeks.

Prevention: Handlers should wash and disinfect their hands after having worked with each animal to prevent the disease from spreading to other animals. Producers should consider adjusting the protein level in the diet of sheep to below 16%.

Important notes: The disease has a major economic impact on the small stock industry and must be managed well to prevent economic losses (poor gestation and lambing percentages).

6.6 TICKBORNE DISEASES

6.6.1 Anaplasmosis

Species affected: Cattle.

Causes and spread: Anaplasmosis is a rickettsia type organism found in the red blood cells of infected animals. Anaplasmosis is transmitted by at least five different tick species. The blue tick is probably the most important vector of the dangerous gallsickness organism, *Anaplasma marginale*. Anaplasmosis can also be transmitted by syringe needles or biting flies.

Prevalence: Is related to the distribution of tick vectors and occurs in all provinces except large parts of the Northern Cape. Anaplasmosis is permanently established in large areas of the country's other eight provinces where vector ticks are present. Outbreaks are more frequent during the warmer summer and autumn months, when ticks and bloodsucking flies are more prevalent and active.

Disease signs: Fever, anaemia, jaundice, rumen stasis, and constipation. A drop in milk production may precede any of these signs of disease. Can be confused with redwater. Sudden deaths (acute) can also occur without noticeably clear disease signs exhibited.

Treatment: Kill the anaplasma organism in the animal's body using effective medication and get the rumen going again. Use home mixtures or commercial products for this purpose. Flush the accumulated bile from the animal's liver with an effective agent. A long-term approach to managing ticks and tickborne diseases, which involves the strategic use of tick killers and vaccine administration, is also important.

Prevention: The live *Anaplasma centralis* vaccine can be administered, especially in areas where vector ticks are not well established. Vaccinate calves between four and nine months of age while they still possess natural immunity. Older animals may respond less well to vaccination and should be closely monitored and treated if necessary. Vaccinate only a limited number of older animals. Protective immunity develops seven to eight weeks after vaccination and usually lasts for several years. Expose vaccinated animals to a 'veld challenge' shortly after vaccination to ensure the development of immunity.

6.6.2 Heartwater

Species affected: Cattle and sheep.

Causes and spread: Caused by a rickettsia bacterium, *Erlichia ruminantium*. It occurs only where the bont tick (*Amblyomma* spp. – also called the heartwater tick) is present. The common bont tick species in South Africa is *Amblyomma hebraeum*. The larvae and nymphs of this three-host tick prefer ground birds, rodents, and small game as their hosts, while the immature ticks will also feed on other animals. The larvae and nymphs are infected with the heartwater parasite. The nymph and adult stages transmit the disease to other susceptible animals. Up to 7% of a tick population in endemic areas may be infected with the disease. Heartwater is not contagious.

Prevalence: Heartwater can be expected if the characteristic green, yellow, and black male tick is present in an area. While the disease traditionally occurred in most parts of Limpopo, northern Gauteng, the Mpumalanga Lowveld, KwaZulu-Natal, and the Eastern Cape, it has also spread to the Western Cape and North West, partly due to the movement of wildlife.

Disease signs: Sudden fever, but not very noticeable. The sick animal is lethargic, feed intake decreases, and the animal appears depressed. Thereafter, severe clinical signs will start presenting, mostly related to the central nervous system (convulsions and hypersensitivity) and the respiratory system (severe breathing problems with foaming at the mouth and nostrils). Affected animals that are not treated usually die within a day or two. However, treatment within the first 12 hours after the first signs of disease are observed is very effective.

Treatment: Two-step treatment: (1) In acute cases, a short-acting oxytetracycline should be administered intravenously, followed the next day by a long-acting oxytetracycline. (2) Supportive treatment by a veterinarian to remove the fluid in the lungs, pericardium, chest cavity, and brain.

Prevention: The heartwater vaccine is a blood vaccine (limited availability) that is administered intravenously. Heartwater must be handled on a per-farm basis. Vaccinate calves within the first three weeks of birth and lambs within the first week. Older animals can also be vaccinated. In areas characterised by large numbers of ticks and the presence of heartwater, some producers use an immunisation method called chemoprophylaxis, a weekly treatment of susceptible cattle and sheep with oxytetracycline for three weeks. It is important that animals that have already developed immunity are repeatedly exposed to the disease. Also follow a strategic dipping programme.

6.6.3 Redwater

Species affected: Cattle.

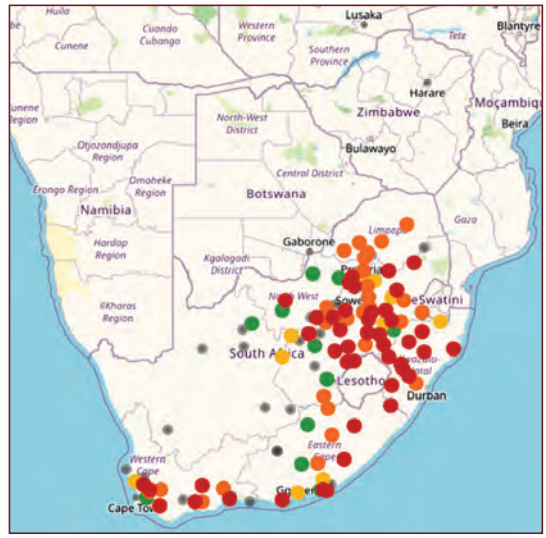
Causes and spread: The protozoan *Babesia* is species-specific and each *Babesia* species is found only in one animal species. African redwater is caused by *Babesia bigemina* and is transmitted mainly by blue ticks, *Rhipicephalus (Boophilus) decoloratus* and *R. (B.) microplus*. Asian redwater is caused by *Babesia bovis* and is transmitted by the pantropical blue tick, *R. (B.) microplus*. The parasites enter the animal's bloodstream when an infected tick bites it. They invade the red blood cells, multiply and cause the cells to burst. Each released parasite then attacks a new red blood cell, multiplies, and the cells burst again, resulting in anaemia and possible death. An immune response occurs during which the animal tries to break down the infected red blood cells itself to fight the infection. However, the parasites have an effect on the clotting factors, which can lead to organ failure.

Prevalence: Redwater can affect any breed of any age. It has been recorded in calves as young as two to three days old, even though the dams showed no symptoms. Calves as young as four months have died from the disease. It is not just a summer disease, and cases have been reported in June and July, even in the colder parts of the country. The disease occurs especially in the northeastern parts of South Africa but is common in the warmer north. However, it has spread considerably and is increasingly confirmed in other parts of the country (*Figure 6.5*).

Disease signs: African redwater is the slower form of the disease with animals showing signs of disease over the span of a few days. These include high fever, lethargy, loss of appetite, pallor, jaundice, and red urine. Asian redwater is more aggressive and can cause animals to die without any visible signs being present, often without pale mucous membranes and red urine, and sometimes with nervous symptoms that cause the animal to act aggressively.

Treatment: A rapid diagnosis by means of a blood smear is necessary when encountering a sick or dead animal. If an outbreak is suspected, the entire herd can be treated with diminazine or imidocarb upon the recommendation of the herd veterinarian. Consider treating rather than losing more animals.

Figure 6.5: African redwater, April 2022 to September 2024. (Source: *www.rmis.co.za*)



- *No danger/no problem.*
- *One case/minor concern and/or low priority.*
- *More than one case/some concern.*
- *More than ten cases/major concern and/or high priority problem.*

Prevention: A redwater vaccine does exist but is expensive and not always available. It should be kept on dry ice and administered intramuscularly immediately after thawing. Consider vaccinating valuable animals, such as stud bulls. Animals should be monitored daily, and even twice daily, after vaccination. Tick control is particularly important. Pour-ons or spray-dip agents are more effective than injectable agents in preventing the transmission of redwater. In herds where redwater has been present for several years, tick control is still important, but not crucial.

6.7 DISEASES PREVENTED WITH GOOD BIOSECURITY

6.7.1 Foot-and-mouth disease (FMD)

Status: Controlled disease.

Species affected: Cloven-hooved animals: Cattle, sheep, goats, pigs, and game, among which the Africa buffalo.

Causes and spread: The disease is caused by the *Picornaviridae* virus, of which several serological variants exist. FMD is found in all secretions and excretions of acutely infected animals, including exhaled air, saliva, milk, urine, faeces, and semen. The virus can be transmitted by direct or indirect contact with infected animals and objects.

Prevalence: Endemic to the Kruger National Park with outbreaks increasingly occurring in other provinces such as KwaZulu-Natal, Mpumalanga, and North West.

Disease signs: Signs of disease that present quickly include fever, and blisters on the feet, in and around the mouth, and on the udder. It can also appear on the vulva, foreskin, or pressure points on the legs. The blisters quickly break open and cause lesions. Pain and discomfort caused by the lesions lead to signs of depression, anorexia, increased salivation, lameness, and reluctance to stand. Cattle usually have a fever and develop lesions on the tongue, gums, soft palate, and nostrils. Although FMD does not penetrate the placenta, abortions may occur in pregnant animals. It usually takes between two and eight days since infection for the animal to exhibit signs of disease, but it can take longer. In young animals, deaths also occur due to inflammation of the heart muscle.

Treatment: No primary treatment. Sores can be treated but ultimately all affected animals must be culled.

Prevention: Biosecurity is the first line of defence, and it is important that regulations regarding the transportation of livestock are complied with. Infected or vaccinated animals may not be moved, sold, or slaughtered without specific measures being observed. Procedures regarding the movement or slaughter of animals, or the introduction of new animals, are calculated on a timed basis starting with day zero, which is considered the day of vaccination, provided that no new active virus is found. The vaccine is therefore not freely available on the market and as a precautionary measure, cannot be administered by anyone. Only the state can decide where and when vaccinations may take place, and only state veterinarians may administer the vaccine. The disease can only be confirmed with the help of samples and laboratory reports.

6.7.2 Sheep scab

Status: Controlled disease.

Species affected: Sheep and goats.

Causes and spread: *Psoroptes ovis,* a microscopic mite that lives on the skin. Mites live and feed on the skin, but do not burrow into it. When they pierce the skin to feed on lymph, they cause inflammation with a subsequent secretion of serum that coagulates on the skin. The females lay up to 100 eggs that can hatch within three days. Transmission of the sheep scab mite occurs mainly during contact between animals.

Prevalence: The disease spreads among sheep especially in the winter months, because the parasites favour the climate in longer wool. During this time, sheep are also more likely to be herded or penned. A distinction must be made between *Psoroptes ovis* and the sheep itch mite, *Psorergtes ovis*. The latter usually occurs in fine-wool breeds. Only an expert can distinguish the two mites.

Disease signs: Sheep scab causes sheep to itch and display irritation, followed by biting and pulling at the fleece, which worsens the condition. The animals also rub against posts or fences to try and get rid of the irritation, which exacerbates the spread of the disease. The mite pierces the skin in order to feed, leading to bare patches that appear crusty or wool that is caked and stuck to the crusted areas.

Treatment and prevention: Biosecurity is the first and most important defence against outbreaks of sheep scab. Treat new animals with injectable ivermectin before introducing them into the existing herd. It is also essential to monitor infestations that occur on neighbouring farms.

Important notes: In case of a positive sheep scab diagnosis, the affected farm and neighbouring farms will be placed under quarantine for approximately six weeks following appropriate treatment. Any slackness on the part of the producer to assist the state in controlling the disease can lead to fines or even imprisonment. Animals with sheep scab can, however, be slaughtered and transported in a sealed vehicle to an appropriate abattoir, provided that a Red Cross permit has been successfully applied for and issued.

6.7.3 Malignant catarrhal fever (*snotsiekte*)

Status: Notifiable disease.

Species affected: Cattle that come into contact with blue and sometimes black wildebeest. A sheep-related strain can also occur where the disease can be transmitted from affected sheep to cattle.

Causes and spread: Viral disease (herpesvirus) carried by wildebeest. Airborne virus (can be carried in the air up to a kilometre). Some theorise that insects also carry the virus.

Prevalence: Areas where game (wildebeest) is kept, and there is close contact between them and cattle.

Disease signs:

- First symptoms start showing two to four weeks after contact with the virus. However, animals can become ill up to seven months after virus transmission.
- Initial watery eye and nasal discharge with the eye turning white from the edge of the cornea to the centre of the eye. The nose surface becomes dry, and nasal discharge forms a hard crust.
- During the advanced stage of the disease, infected animals often breathe through their mouths.
- Mucous membrane in the mouth is red, with sores on the inside of the lips, on the gums, on the palate and on the bottom of the tongue.
- The lymph nodes are enlarged and clearly visible in the area beneath the ear and can be felt just in front of the tip of the shoulder joint.
- Cattle die over a period of a week.

Treatment: There is currently no effective treatment and emergency culling must be carried out as soon as possible after the disease has been confirmed.

Prevention: No vaccine available (2025) yet.

Important notes: Keep cattle away from wildebeest, especially when the latter is calving, the calves are being weaned, the animals are caught or transported, hunted, or handled in a way that subjects them to stress (the virus is released in large quantities under stressful conditions). Cattle should be kept at least 500m, but preferably 1 000m (1km), away from wildebeest.

6.7.4 Tuberculosis

Status: Controlled disease.

Species affected: Mostly cattle, but almost all other mammals (livestock, game, and pets) can contract it.

Causes and spread: The bacterium, *Mycobacterium bovis* (*M. bovis*) causes bovine tuberculosis. Transmitted through direct contact between animals and can also be transmitted to humans, although few cases of tuberculosis in humans are caused by *M. bovis*. Can also be ingested through unpasteurised milk.

Prevalence: Countrywide.

Disease signs: The animal's lymph nodes, lungs, udder, and other internal organs are affected. The bacteria can remain dormant in the host for extended periods. Animals can suddenly lose weight, and their coats may become dull. Enlarged, prominent lymph nodes and a poor appetite may occur. Breathing problems can also occur and in the case of a lung ailment, the animals may exhibit a suppressed, moist cough.

Treatment: None.

Prevention: Bovine tuberculosis has been a state-controlled disease since 1911 and cattle must be tested for the disease at least every two years. If they test positive, the state veterinarian must be informed. Measures such as quarantining and culling infected animals may be required. The best approach is to take preventive action by applying basic biosecurity practices on the farm. Keep animals together in groups and breed your own replacement animals. Newly purchased animals should be kept in isolation for some time and tested before being introduced into the rest of the herd.

Important notes: Tuberculosis is a zoonosis and can also be transmitted to humans. However, most cases of tuberculosis (more than 90%) in humans are caused by *Mycobacterium tuberculosis*, or human tuberculosis.

6.8 DISEASES PREVALENT IN LIMITED AREAS

6.8.1 Rabies

Status: Controlled and notifiable disease.

Species affected: All mammals, including humans (zoonosis).

Causes and spread: *Lyssavirus*, secreted in saliva, usually when an infected predator bites another animal or human. Transmission also occurs through saliva in these deep bite wounds. The virus then enters the nervous tissue and travels along the nerve pathways to the brain, where it causes severe damage.

Prevalence: Countrywide with certain high-risk areas: rural areas such as KwaZulu-Natal, the Eastern Cape, Rustenburg and surrounding areas in the North West, the northern parts of Limpopo, the eastern and southeastern parts of Mpumalanga. There has been a significant increase in rabies incidents in animals since 2021, most of which have been reported in the Eastern Cape.

Disease signs: Behavioural changes (aggression, not eating, not drinking water, continuous belching and straining as if the animal wants to defecate, but nothing comes out) in cattle are very typical of the disease and an infected animal can die within three to four days. The clinical presentation overlaps but always has a neurological component. There are two syndromes:

- **Furious (hyperactive) form:** Animals act aggressively with foam and saliva running from mouth due to the animal's inability to swallow. Cattle in particular have their vocal cords affected and bellow loudly and abnormally harshly. An animal's hind legs will wobble, and cattle develop paresis (they remain hunched as if constipated). Another danger sign is severe salivation in cattle, especially if accompanied by unsteadiness on their feet.
- **Paralytic (dumb) form:** Wild animals act docile and will even walk into houses. Paralysis in the later stages of both forms is not ruled out.

Treatment: There is no treatment. A bite wound must be cleaned immediately with soap and water but should not be bandaged.

Prevention: Only through vaccination. A typical vaccination programme involves the administration of inactivated vaccines that are safe for all age groups and circumstances. As a rule, cattle and sheep are not routinely vaccinated, but if rabies has been diagnosed on a farm, calves as young as three months of age as well as adult animals can be vaccinated.

Important notes: Rabies is a highly contagious and fatal zoonotic disease that can only be effectively prevented by timely immunisation. Symptoms in humans are non-specific and include headaches, fever, or intestinal problems. If the virus was transmitted by an animal bite, the bite site will be painful and itchy. Neurological symptoms such as irritability, depression, anxiety, and insomnia may occur. This is followed in a later phase by neurological signs such as restlessness, slurred speech, fear of what is coming or going, hallucinations, and convulsions.

6.8.2 Johne's disease (paratuberculosis)

Status: Controlled disease.

Species affected: Ruminants and some types of game. Sheep are highly susceptible.

Causes and spread: Bacterium, *Mycobacterium avium* subsp. *paratuberculosis*. Bacteria are excreted in the manure, and newborn lambs can ingest it via the ewe's infected teats or on grazing. The bacteria can withstand heat, cold and drought, and can survive in soil and water for up to a year.

Prevalence: Disease incidence is currently quite limited, but it can spread very quickly. One animal can excrete large numbers of bacterium onto grazing.

Disease signs: Chronic emaciation. Disease signs usually only become visible amid stressful conditions such as lactation, pregnancy, or environment changes. The bacteria cause a thickening in the intestinal tract that negatively affects food absorption. Mortalities of up to 15% can occur. Symptoms can easily be misinterpreted.

Treatment: No available treatment. Control depends on good management practices that include regular testing of new animals entering the farm.

Prevention: An inactivated vaccine is available and can only be administered once to sheep aged two months. The vaccine provides an elevated level of protection against the disease but can make it seem as though the disease has completely disappeared. It can reduce the excretion of germs in the flock and thus reduce the level of infection on the farm. Carrier animals will then be significantly reduced. The vaccine is quite expensive and can cause severe skin damage. Serological tests cannot distinguish between infected and vaccinated animals. The best prevention is to only buy animals from breeders who can declare by means of a seller's declaration that their flock tested negative for the disease and poses a minimal risk.

Important notes: The disease has enormous implications for any producer on whose farm it is identified. Animals cannot simply be tested and culled. If the disease is present on your farm, it is very difficult to get rid of it. Legislation requires that farms where Johne's disease is confirmed are placed under quarantine. They may only sell sheep to an abattoir or another farm with confirmed Johne's disease and may not hold an auction.

6.9 VACCINATION AND IMMUNISATION

The incidence of infectious diseases and internal parasites varies from one region to another, both with regard to the type of parasite or disease and the season. The incidence of these problems is closely linked to climate conditions and other factors such as type of grazing, topography, livestock concentration, and the like.

It is impossible to prescribe an effective vaccination or dosing programme for the entire country. It is only possible to recommend basic guidelines which have to be adapted in accordance with local conditions.

The producer should therefore liaise as closely as possible with his nearest veterinarian. Regular examination of sick animals, post-mortems, and manure examinations would enable the veterinarian to keep abreast of the incidence of parasites and diseases in the region and on individual farms.

Dr Faffa Malan, wrote on *landbou.com* that the following factors should be taken into account when compiling a comprehensive immunisation and dosing programme:

- **Herd composition:** rams, ewes (pregnant, dry, young ewes).
- **Climate:** rainfall (winter or summer), temperatures.
- **Size:** farm, paddocks.
- **Feedlot:** size, slope, shade, mud.
- **Water sources:** streams, fountains, troughs, dams.
- **Grazing:** type, cultivated, irrigated.
- **Grazing system**.
- **Farming practices:** breeding, lambing and calving seasons, weaning times.

Which diseases are a problem?

- Prevailing diseases in the area – pulpy kidney, bluetongue, pasteurellosis, enzootic abortion, blackquarter, uterine blackquarter, tetanus, brucellosis.
- Diseases which are a threat, possibly introduced by mosquitoes or midges – Rift Valley fever.
- Diseases which might have been bought in – ovine pulmonary adenocarcinoma (*jaagsiekte*), Johne's disease, abscesses, orf.
- Diseases caused by the producer – botulism as a result of feeding chicken litter, abscesses from infected shears.

Which parasites are a problem?

- **Internal:** Roundworms, flukes, tapeworms. What is the status of the livestock's resistance to these parasites on the farm?
- **External:** Ticks, mites, lice, fleas. What is the status of resistance of parasites on the farm to control measures?

Draw up a risk profite in conjunction with your veterinarian and decide which precautionary measures to take (vaccination and dosing).

There are certain vaccinations which are legally compulsory, such as vaccinations against anthrax in cattle and brucellosis in heifers under the age of eight months.

Make a list of diseases found in the area against which livestock must be immunised (essential vaccines). Consult your veterinarian on the diseases that occur most frequently. Examples in cattle are blackquarter and botulism. Among sheep and goats the most common diseases include pulpy kidney, bluetongue, pasteurellosis, enzootic abortion and abscesses.

Make a list of diseases that do not occur regularly in your area but that could present a threat to your livestock (non-essential vaccines). Some examples are tetanus, Rift Valley fever, lumpy skin disease, malignant oedema, redgut (*rooiderm*), bloodgut (*bloedderm*), lamb dysentery, orf, *E. coli*, BVD and neosporosis, to name a few.

Once a list of essential and less essential vaccines has been compiled, the next step is to plan when to administer the vaccines.

Immunisation programme

While it is not possible to provide a schedule for each specific vaccine, there are general guidelines that can be followed.

Newborn animals are passively protected by maternal antibodies ingested with the colostrum. It is therefore important that the mother's immunity against the prevailing diseases on the farm should be optimal and the newborn animal should receive a timely intake of sufficient colostrum. As a result of the high levels of maternal antibodies it is therefore difficult or impossible to immunise newborn animals successfully.

Young animals can only be vaccinated successfully when the maternal antibodies have decreased sufficiently. Because it is impossible to determine when the antibody levels have decreased sufficiently, young animals have to be vaccinated twice. Farm animals should receive the second vaccination at six months. Animals with no maternal antibodies can be successfully immunised at a far younger age.

The intervals between vaccinations vary. Inactivated vaccines which induce poor memory should be administered more frequently (e.g. *Arcanobacterium* pyogenes – every six months). Live vaccines provide protection for a longer period and need only be boosted after two or three years. Some vaccines induce lifelong immunity (e.g. live Rift Valley fever vaccine).

The decision to administer a vaccine could also depend on when the risk is greatest. If chicken litter is fed, for instance, the risk of botulism is very high. In the rainy season the risk of bluetongue,

horsesickness, Rift Valley fever, and three-day stiffsickness is far higher.

It is important that three to four weeks should elapse after the primary vaccination (first time an animal is vaccinated with a specific antigen) before a booster is administered.

With any vaccine, read the instructions on the package insert carefully before use.

Vaccination vs immunisation

Vaccination simply refers to purchasing a vaccine and administering it in the hope that the disease involved will be prevented. Immunisation occurs when the vaccine is administered on a planned basis, according to a vaccination plan drawn up in collaboration with a veterinarian. This plan firstly considers the stage of production and nutritional status of the animals to be vaccinated. A vaccine can only stimulate the immune system to develop good immunity if animals are vaccinated when in good condition and not subjected to excessive stress.

SOURCES
- *Livestock production manual*, 2017. Red Meat Producers Organisation (Pretoria).
- Odendaal, D. 2024. Vaccination and immunisation: Two sides of the same coin.

6.10 THE FAMACHA FIVE-POINT PLAN

Wireworm infection is one of the most common diseases found in sheep and goats, especially in the summer rainfall areas. Wireworms are bloodsuckers that cause anaemia of which a clinical sign includes pale mucous membranes. Normal mucous membranes are red, but wireworm infection causes mucous membranes to turn

pink and later white, after which the animal dies. Another sign of the disease is so-called bottle jaw.

The problem presented by this parasite is that there is no drug that offers 100% control. As a result, selection focusses on specific resistant wireworm strains, after which the problem is exacerbated and spreads rapidly.

Living with the problem

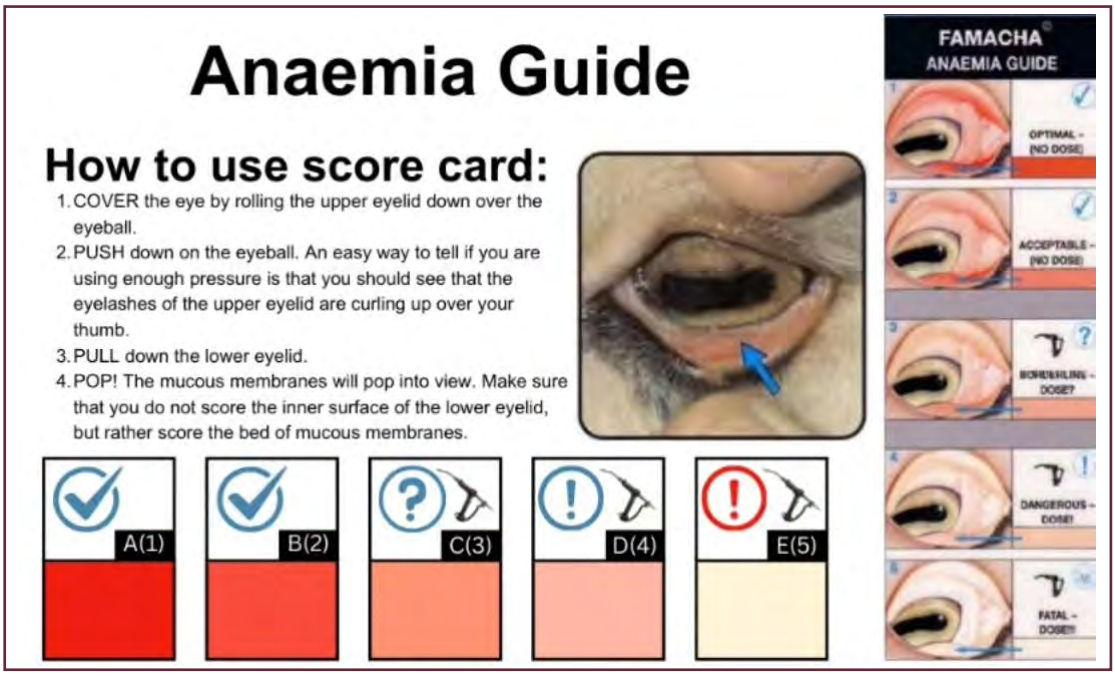
Well-known veterinarians, Dr Faffa Malan and Prof Gareth Bath, believe that it is better to live with the problem than to treat your animals in a way that allows the parasite to become a bigger problem eventually, despite the treatment.

Prof Bath says the biggest issue is the misuse of anthelmintics by producers. "On many farms there is resistance to many groups of drugs. This threatens the sustainability of sheep and goat farming, as one cannot rely solely on medication to control parasites," he says.

Most sheep and goats are able to tolerate the discomfort of worm infestations and only a small number of animals in a flock actually become sick because of it.

The Famacha solution

Dr Malan identified this problem years ago and created the Famacha system, which is named after him. He developed the



Famacha system (FAffa MAlan CHArt) in collaboration with Prof Bath and Dr Jan van Wyk.

This system involves comparing the colour of the mucous membranes in the eyes of sheep and goats with colours on the chart to measure their anaemia (internal parasite infestation) levels. Only heavily infected animals are then treated. This keeps the build-up of resistance to medication in check and helps to identify animals that offer natural resistance to parasites.

He says it is not necessary to dose the entire flock every time. "Besides it being an expensive process, repeated dosing will encourage the selection of resistant parasites. Research has also shown that sheep and goats have an inherent ability to prevent, suppress or resist parasite infections. Animals can therefore be bred to resist parasites in a natural way."

He believes the old theory of shaking a box of matches next to each sheep's ear every day provides actual answers. "There are easier ways of treating against wireworm by going through your flock regularly and treating only those animals that are unable to handle a wireworm infection. For this purpose, the Famacha method is highly effective."

Dr Malan, Prof Bath, and Dr Van Wyk first tested and implemented the system in South Africa. It has been tested in various other countries since 1990 and each time the system proved successful.

Famacha examination

Dr Malan says wireworm cause anaemia which would normally be tested for and confirmed in a laboratory. With the Famacha system, however, producers can determine it themselves.

"Blood consists of plasma (a clear liquid part) and red blood cells. The ratio of red blood cells to plasma determines whether an animal is healthy or sick. Too many or too few red blood cells is an indication of illness. This ratio is usually measured in a laboratory, but with practice it can be determined quite accurately by looking at the colour of the animal's eye mucous membranes.

"Wireworms are leeches and heavy parasite infestations will lead to a low ratio of red blood cells to plasma. The eye mucous membranes are then paler than they should be. By looking at the mucous membranes, one can therefore determine which animals are anaemic and require treatment," he explains.

Advantages of the method

Prof Bath says there are many advantages to this screening method. Not only does it save on medication; it also helps sheep and goats to naturally protect themselves against infection and to prevent parasites from becoming resistant. "This way, sheep that exhibit clinical signs of a wireworm infection are identified timeously and are treated with an effective drug before the symptoms get out of hand. These animals should in fact be culled."

According to Dr Malan, it will be possible to notice more easily which animals have been treated with ineffective medication as there will be fewer sheep to monitor. When using an effective drug for treatment, the pale mucous membranes in the eyes will start improving within a week or ten days, provided the animal's protein intake and body condition are adequate.

In his experience sheep that are treated only when it is absolutely necessary are stronger and can better resist the effects of wireworm. "The problem is more easily identified by regularly examining your sheep. It then also becomes easier to identify the camps or pens where these parasites occur."

Dr Bath says another advantage of the method is its cost-effectiveness. Inspecting animals' eyes can be performed in conjunction with other actions, such as vaccinating or weighing animals. He says up to 500 sheep can easily be examined in an hour's time.

Potential problems

According to Dr Malan, there is never a clear answer for all diseases and therefore precautions must also be taken. "The Famacha system allows for thorough examination of wireworm infection. Although several other bloodsucking parasites are successfully identified during this process, this system only guarantees wireworm control. We have not yet tested it as thoroughly on other parasites."

He emphasises that the Famacha method must complement a good parasite control programme and cannot be used on its own to control parasites. "Although wireworm is the biggest cause of anaemia, other sources of infection can create confusion, such as liver fluke, external parasites, blood parasites, infections, and even nutritional deficiencies.

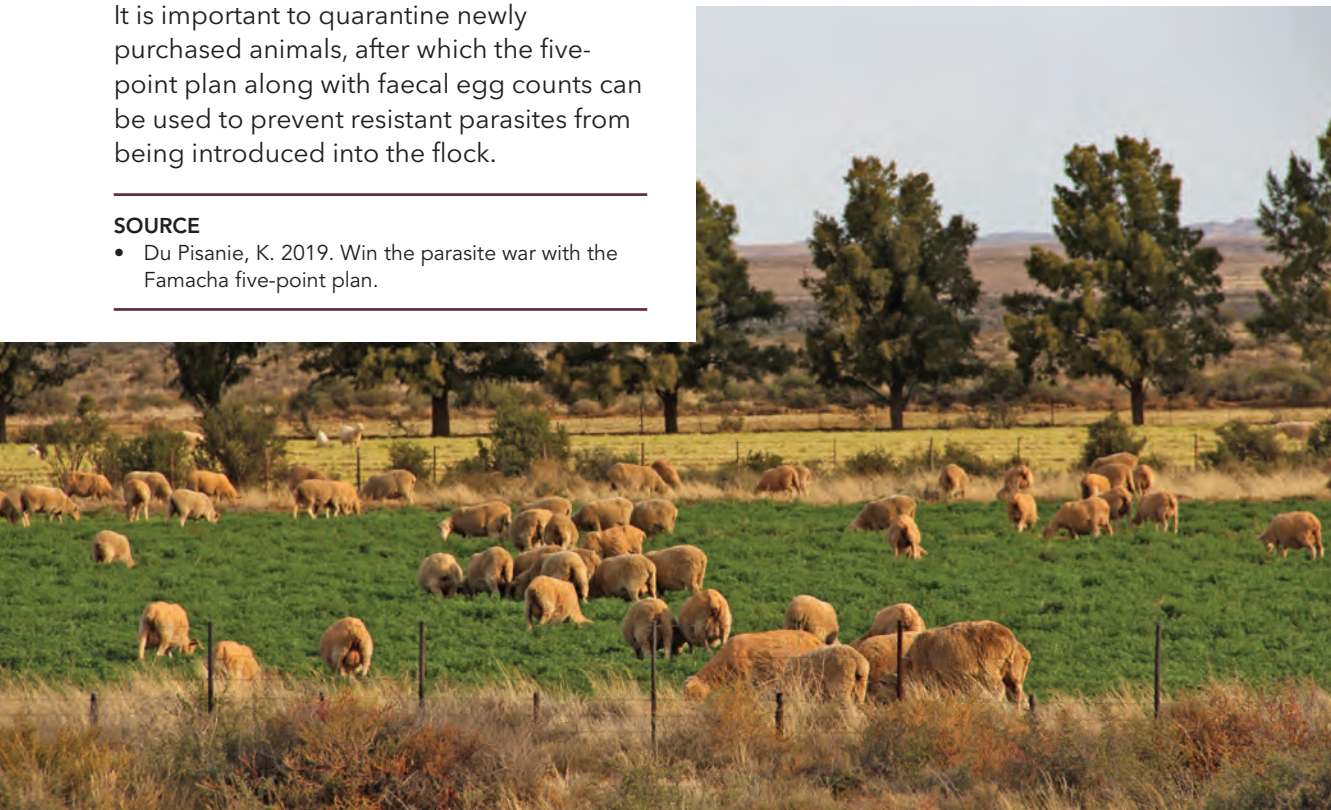
"In addition, there are other conditions that can affect an animal's eye mucous membrane and create the impression of anaemia. These include dust or hot, dry conditions that irritate the eyes when animals are driven over long distances without sufficient rest, present with fever, infectious eye diseases and diseases associated with poor blood circulation."

The five-point plan

Dr Malan and Prof Bath drafted a five-point plan that every producer can use during flock examination to control most parasites on their farm. Step one involves the Famacha method. The other four steps in the plan involve:

- **The nasal area:** By checking the nose, the examiner can easily determine whether an animal has been infected with nasal worms. Signs include a watery discharge from the nose, which hinders the animal's sense of smell and has a negative effect on its ability to gain weight. Other diseases and parasites that can also be identified with this examination are lungworm, pneumonia, bluetongue, and orf.
- **Body condition score:** To determine the body condition score, an animal's loin area must be measured. Animals that are underweight, in particular, are likely to be infected with parasites such as brown stomach worm, bankrupt worm, long-necked bankrupt worm, nodular worm, and conical fluke.
- **Manure examination:** Examining a sheep or goat's manure can also indicate parasite infection. Clean manure indicates that the animal is healthy. However, if the manure runs into the wool and stains its hind legs, it is an indication of diarrhoea which is often caused by parasites. Other diseases or parasites that also cause diarrhoea are brown stomach worm, bankrupt worm, long-necked bankrupt worm, nodular worm, pinworm, conical fluke, cryptosporidiosis, and coccidiosis.
- **Bottle jaw:** Bottle jaw is a clinical sign that is common in wireworm and liver fluke infections. These parasites can result in weight loss and death, and can have an impact on the animal's immunity and fertility.

It is important to quarantine newly purchased animals, after which the five-point plan along with faecal egg counts can be used to prevent resistant parasites from being introduced into the flock.

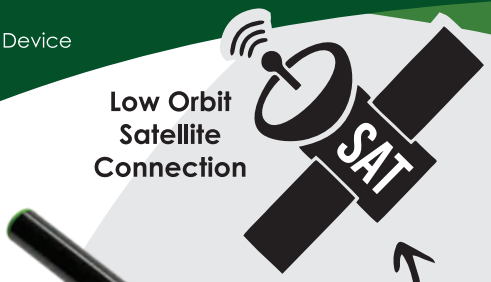


SOURCE

- Du Pisanie, K. 2019. Win the parasite war with the Famacha five-point plan.

SAT: Satellite
VLS: V2F Livestock Scale
LITS: Livestock Identification Traceability System
EID: Electronic ID Tag
RFID: Radio Frequency ID Device

GMPBasic® SYSTEM



Low Orbit Satellite Connection

GPS Co-ordinate

GPS Co-ordinate

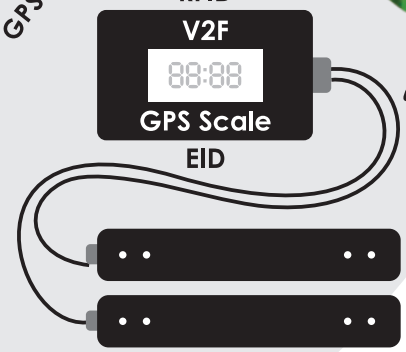
V2F VERIFIER:

- Verify Position SAT
- Verify GMPTags® - Visual
- Visual ICAR Approved
- Closed Ended
- Non - Reusable
- Database Compliant

RFID Reader: GPScanID

GPS Co-ordinate

RFID



EID RULES:

LITS Approved •
ICAR Approved •
Closed Ended •
Non - Reusable •
Database Compliant •

LPV PROGRAM

- Producers
- Back Ground
- Feedlot

V2F
VET 2 FARM

VERIFICATION

- Movements
- MX-V2F Livestock
- André Kock
- BKB
- Karoo Osche
- Vleissentraal
- Feedlots
- Abattoirs
- Insurance
- Etc.

DISEASE & TESTS

- Brucellosis
- T.B.
- Trichomonas
- Vibriosis
- EBL
- DNA
- Fertility
- Pregnancy
- V2F FMD EPI-Status

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7 TRACEABILITY

7.1 THE PRINCIPLE OF TRACEABILITY

Traceability, individual animal identification and record-keeping systems are concepts that are often lumped together. Although data is central to these concepts, traceability is rather an overarching concept that encompasses a network of data points and within which record-keeping systems play an integral role. Individual identification ensures that each animal can be distinguished from another and is therefore the primary principle on which the systems are based. Record-keeping systems, typically farm software or computer platforms, capture and store data, whereas traceability connects these data points across different processes or systems, allowing them to be meaningfully tracked.

Record-keeping systems are therefore systems that store information and retrieve it when you 'request' it. Traceability, however, allows you to follow the history and movement of a product, in this case livestock or meat, and to track all activity based on the data obtained from the record-keeping systems of different links in the value chain.

A traceability system for livestock means that a complete record is kept of the ownership and movement of livestock through all phases of their lives. It is therefore very important that such a system is reliable and credible.

The 'movement' of an animal or product is usually from the farm or source of origin, to where the final product ends up in the consumer's hand or the newly purchased bull is introduced to the producer's kraal. Of course, there are multiple processes that form part of this broad concept, making it more complicated than it may seem at first glance.

It starts with the ability to mark an animal or item for identification and then record all additions, changes and movements so that, among others, ownership can be proven in the event of a dispute, animals and their movement can be identified in the event of a biosecurity breach, and control can be exercised over erosion diseases that can result in financial losses. It also allows for the day-to-day management of individual animals and the identification of those that perform well or poor in terms of production and reproduction.

There are different areas in which traceability plays a role in the food chain, including:

- Breeding and selection (pedigree and origin).
- Health management.
- Nutrition management.
- Processing chain management.
- Marketing chain management.
- Liability and risk management.

7.2 LEGAL REQUIREMENTS

According to current requirements set out in the *Animal Identification Act, 2002 (Act 6 of 2002)*, livestock owners must mark their animals with a registered identification mark. The *Act* allows for the use of tattoos and branding. Livestock must be marked at specific ages which may vary among species.

Identification marks allow for the identification of the owner of the livestock; however, there is no legal requirement to distinguish between individual animals. The system records the livestock owner's residential address and not necessarily where the livestock is kept.

Several countries have already implemented their own versions of livestock identification and tracking systems (LITS) and these appear to be working well. It is not only the more advanced countries (European Union, Australia, and America) that use these types of systems, but there are also countries in Africa such as Namibia, Botswana and Ethiopia that have traceability systems in place. In most of the countries where these systems are used, it is mandatory for producers to comply with their provisions.

7.3 WAYS TO MARK ANIMALS INDIVIDUALLY

In the past, like in Botswana, boluses were swallowed by cattle and used to identify them by means of an electronic reader. These boluses, however, appear to cause problems in cases where the electronic reader can no longer detect the bolus. In addition, boluses cannot be recovered before animals are slaughtered. Electronic chips implanted under the skin could be an option in some cases and for some species. However, the problem with both boluses and microchips is that they are not visible, and therefore it cannot be confirmed whether animals are properly marked.

Most traceability systems work with ear tags which requires an ear tag (usually yellow) with a unique number lasered onto it. Another option is using radio frequency ear tags (RFID) which, together with the visual ear tags, helps to distinguish between individual animals and to keep records. The country of origin is also indicated on the tag (e.g. NAM for Namibia).

Most countries have a single agency responsible for issuing ear tags, although in a few countries ear tags can be obtained from more than one supplier.

7.4 THE WHEN AND WHO OF BRANDING

While there is currently no legislation in South Africa that mandates the individual identification and traceability of animals, the industry is working on it. However, before any record-keeping or traceability system can be implemented, producers must register on it.

The age at which livestock must be tagged differs among countries. This difference likely pertains to production

conditions and the target market to which livestock and/or their meat products are exported. In some countries, livestock must be correctly tagged from as early as 20 days after birth while in others it can be done as late as six months of age.

Once the livestock has been tagged, all information must be uploaded and stored on a database. Producers can either upload the information themselves to an online platform or send the information to the relevant authority for uploading. In addition to births, these central databases also keep records of livestock movement, ownership changes, place of birth and deaths, among others.

Regarding the transport of livestock, some countries require permission to be obtained before the livestock can be transported or moved, while others only expect notification once the animals have already been moved. Animal movement records are also stored and checked in the event of disease outbreaks.

One of the greatest challenges regarding traceability in South Africa lies in the documenting of animals before they reach the feedlot; there is no mandatory national system. One of the most important principles of successful traceability is that it must start on the farm, where an effective identification system includes basic information such as birthweight, weaning weight, parentage, vaccinations, disease treatment, dehorning dates, weaning dates, selection status and marketing history. It also includes feedlot performance as well as the final dressing percentage and grading, and the movement of the carcass throughout the value chain until it reaches the consumer.

7.5 SHORTCOMINGS

Unfortunately, when it comes to red meat products, there is rarely an uninterrupted line of information regarding an animal from the farm of origin to the retail outlet selling the final product. Feedlots keep meticulous records of their animal intake, especially for export purposes, but upon intake the producer's information is not necessarily integrated with the feedlot's.

The producer, along with his herd veterinarian, must at least be able to confirm the following for traceability purposes:

- What breed and type of calves (frame size) are being supplied.
- That the calves were bred and born on the farm in question.
- That they have not been mixed with calves of another origin.
- That the producer has a herd health plan which is overseen by his veterinarian.
- That each calf can be individually identified.
- That there is visible evidence of the type, condition and constitution of the calves.

If all these requirements can be met, the feedlot can rest assured that the calves are low-risk, high-potential animals that meet the feedlot's specific needs.

South African weaner calf prices are often lower than the rest of the world's, which is a good indication of why a traceability system is needed locally and can open international doors. An increase in red meat exports can make a huge difference to the industry's profitability, but to get to that point South Africa's animal health status and traceability must improve drastically.

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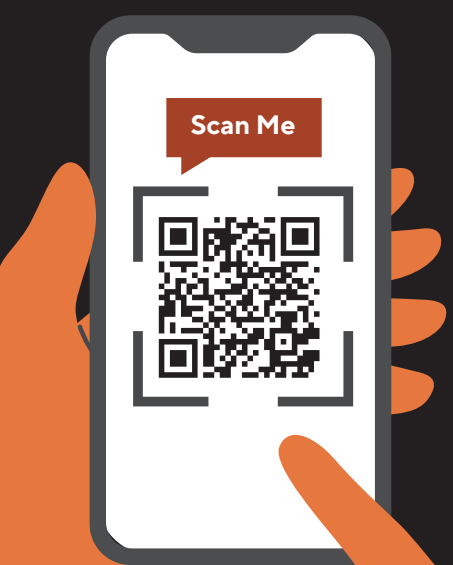
What happens if we ignore traceability?

- We lose market access
- Disease risks increase
- Consumer trust drops



What you'll need to register:

- Name and Surname
- Contact Number & Email Address
- Are you the owner or a renter?
- Type of farming enterprise
- Farm location & GPS

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7.6 PURPOSE OF A DECLARATION

The veterinarian already has a complete overview of the animal health management plan on the farm, including all vaccinations. Because the veterinarian normally tests the bulls before the breeding season, he also has knowledge of the bulls used. A producer declaration issued together with a declaration by the herd veterinarian currently forms the foundation of traceability efforts in South Africa, as there is no existing system. The declaration may, for example, contain information such as the producer's full name and address, the registered brand, the name and GPS coordinates of the production unit or farm, an individual description of the weaned calves (sex, breed/type, identification or ear tag number, vaccinations, etc.). The herd veterinarian's signed declaration can in turn confirm that the information on the producer declaration is correct, that all the calves have been identified, and that a health management plan is in place.

7.7 BENEFITS OF TRACEABILITY

In 2016 the Food and Agriculture Organization (FAO) of the United Nations published a document emphasising the development and integration of record-keeping systems for dual-purpose animals. The document lists several benefits of animal traceability.

Food safety and quality control of food products of animal origin are among the benefits of a proper traceability system, as the food product can be traced back to the source. This means contaminated and poor-quality products can be quickly withdrawn from the value chain before they reach the consumer. It is therefore important that the traceability system extends beyond the point of slaughter to where the product reaches the shelf.

Another benefit of traceability systems is access to export opportunities and product certification. It can play an important role in ensuring that exporting countries meet the sanitary and phytosanitary standards of higher-value export markets. The benefits and beneficiaries of traceability will vary, depending on the scope and completeness of the traceability system's records.

Collecting animal health information is also one of the main reasons for establishing a traceability system as it can be used to determine the health status of the national herd. Determining the latter is a prerequisite for planning any surveillance or control strategy, as well as where a compartmentalisation policy is to be implemented.

Traceability can play an important role in ensuring that countries meet their international obligations regarding the reporting of animal diseases and early detection thereof. Quick action can limit direct and indirect losses, and restore consumer confidence. Animal health information can also be useful in determining the incidence of diseases and the impact of the diseases on animal production and mortality.

Depending on the type and scope of information collected by a country's traceability system, it can offer benefits in terms of performance and production records. A national traceability system will offer statistics regarding the number of animals in the country and production per species.

In turn, this information will be useful for producer organisations and decision-makers during planning to improve a

country's food security and increase livestock productivity. Because animals are managed individually, it will facilitate producers' day-to-day decision-making regarding the culling of animals.

The report states that traceability systems can ultimately be used to reduce livestock theft by establishing ownership. Because the system keeps a complete record of livestock movements, it can be used to track animals in times of natural disasters and return them to their owners. Livestock insurance can be secured more easily if each animal can be identified individually.

7.8 BIOSECURITY

One of the most important elements of a proper traceability programme or plan is biosecurity. Addendum 1 to the RPO *Code of Best Practice* contains preventive measures that require herds to be protected from diseases acquired through external contact. The following categories are of importance.

7.8.1 Direct livestock purchases (and own animals returning)

The following should be verified before importing new animals into the herd:

- How long the animals were kept at the point of purchase or previous location.
- Whether any recent disease outbreaks occurred in the area.
- Whether any brand marks are present to clearly confirm ownership.
- Whether a vaccination programme was followed (documentary or veterinary proof required).
- Local prevalence of external parasites and the routinely implemented control programme.
- Whether a veterinary supported control programme is followed in respect of transmissible diseases.
- The dates and number of tests performed in respect of reproductive diseases of both male and female animals.
- Dates and tests conducted regarding zoonotic diseases.

The purchaser's own veterinarian must also confirm all the above.

7.8.2 Purchases from sales or speculators

- Purchase only in areas that are not in close proximity to disease management areas.
- Visually inspect the animals for brand marks and parasite incidence before purchase.

7.8.3 Transport to the farm

- Use only reputable transporters.
- Check that the truck has been cleaned and disinfected.
- The truck must follow the shortest uninterrupted route.
- The truck must follow the shortest route to the handling facilities.
- Do not allow the truck personnel to come into contact with the farm herd.

7.8.4 Arrival at the farm

- Limit stress when offloading the livestock and visually evaluate them for any unnatural conditions and behaviour.
- Isolate them from the farm herd and shared facilities for at least 21 days (quarantine) and preferably 28 days.
- If necessary, re-test for diseases that may be cause for concern before introducing the new animals into the rest of the herd.
- Process new arrivals within 24 hours of their arrival (unique ID tag, brand, dip, dose, vaccinate).
- Perform regular inspections.

7.8.5 Feed purchases

- Do not source hay bales from areas bordering disease demarcated areas.
- Purchase feed only from reputable dealers.
- Avoid buying feed supplied in second-hand bags.
- Ensure that feed trucks are disinfected and cleaned, especially if they are also used for transporting animals to abattoirs.

7.8.6 Visitors

- Do not allow strangers or their vehicles near the livestock.
- Ensure that fences are well maintained and preferably jackal- and warthog-proof.

7.8.7 Employees

- Employees must be prohibited from eating in feed stores.
- Provide sufficient ablution facilities for all staff.
- Regularly arrange for employees to be treated against tapeworm and to undergo health check-ups.
- Keep record of all livestock belonging to employees that are kept on the property.
- Treat employee livestock with separate but dedicated health programmes.
- Ensure that employees understand why these biosecurity measures are necessary so that they can assist in ensuring compliance.

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8 HUMAN RESOURCES AND EMPLOYEE ADMINISTRATION

8.1 BEST LABOUR PRACTICE

Workers that are resolute and motivated is one of the most important factors contributing to a successful farming enterprise, which is why producers should pay sufficient attention to labour as a production input. Workers should be treated with respect and remunerated fairly. Trust and good relations are conducive to success.

The guiding principle contained in the RPO's *Code of Best Practice* is that producers must ensure that the rights and welfare of farm workers and their families are protected, and that they contribute to the social and economic development of the local community and the community in the surrounding area.

The basic premise is that producers are the pillar of the economy in towns, townships, and the surrounding rural areas. Producers also have the knowledge and skills to promote the development of a viable and sustainable local economy.

Research has shown that agricultural growth and the efficient management of natural resources depend on the political, legal, and administrative abilities of local communities to shape their own future and protect their natural resources and economic interests.

The information contained in the labour section of the *Code of Best Practice* was derived from the following laws. Bear in mind that most of these laws have been amended since their commencement date. The links below will take the reader to the original versions. It is important to also consult their amendments and to remain informed of the latest version of each law:

- *Labour Relations Act, 1995 (Act 66 of 1995)*
  (www.gov.za/sites/default/files/gcis_document/201409/act66-1995labourrelations.pdf)
- *Employment Equity Act, 1998 (Act 55 of 1998)*
  (www.gov.za/sites/default/files/gcis_document/201409/a55-98ocr.pdf)
- *Basic Conditions of Employment Act, 1997 (Act 75 of 1997)*
  (www.gov.za/sites/default/files/gcis_document/201409/a75-97.pdf)
- *Skills Development Act, 1998 (Act 97 of 1998)*
  (www.gov.za/sites/default/files/gcis_document/201409/a97-98.pdf)
- *Compensation for Occupational Injuries and Diseases Act, 1993 (Act 130 of 1993)*
  (www.gov.za/sites/default/files/gcis_document/201409/act130of1993.pdf)
- *Land Reform (Labour Tenants) Act, 1996 (Act 3 of 1996)*
  (www.gov.za/sites/default/files/gcis_document/201409/act3of1996.pdf)

The *Labour Relations Act* deals with rights contained in the *Bill of Rights* of the *Constitution of South Africa*. The following rights apply to livestock producers:

- The right to freedom of association of both employee and employer.
- The protection of employees and of persons seeking employment.
- The protection of the rights of employers.
- The organisational rights of employees such as access to the workplace by a representative of a trade union.
- Collective bargaining rights, the right of employees to strike, and the right of employers to have recourse to lock out employees.
- Unfair dismissal and unfair labour practice.
- Supporting codes of good practice which deal with fair dismissals, sexual harassment, and HIV/Aids in the workplace.

The *Basic Conditions of Employment Act* was promulgated to advance economic development and social justice by giving effect to the right to fair labour practices. This is supported by a code of good practice which regulates fair working time and the influence of working time on the health, safety, and family responsibilities of employees.

The *Skills Development Act* was promulgated to develop the skills of the South African workforce, to improve the quality of life of workers, their prospects of work and ability to compete for work, their productivity in the workplace and accordingly the competitiveness of employers, and to promote self-employment and improve the prospects of job opportunities through training and education.

The *Compensation for Occupational Injuries and Diseases Act* was developed, *inter alia,* to provide for the health and safety of people in the workplace,

those who are exposed to potentially hazardous equipment, and those in close proximity to where the work is done.

The *Land Reform (Labour Tenants) Act* was promulgated to provide for security of tenure of labour tenants and those persons occupying or using land due to their association with labour tenants. The *Act* also provides for the acquisition of land by labour tenants and their right to land tenure.

Members of the RPO should commit to the following:

- Complying with the conditions of fair labour practices laid down by law.
- Contributing to unemployment insurance for employees.
- Contributing to the development of employees' skills.
- Making provision for remuneration in the event of death or disability arising from labour activities.
- Making provision for the health and safety of people in the workplace.
- Considering the rights of labour tenants and to acquire land when suitable.
- Making recreational areas available on the farm.
- Participating in activities that will promote a sustainable economy in the community. One way of complying with the latter is by giving preference to residents from the local community or people living on the farm when filling posts.

SOURCES

- *RPO and NERPO Code of Best Practice for Sustainable and Profitable Red Meat Production, 2023 (revised).*
- *Labour. Livestock Production Manual, 2017.*

8.2 TYPES OF EMPLOYMENT CONTRACTS AND EMPLOYEES

South African legislation requires the employer to provide an employee with the details of his or her employment. A written employment contract, which outlines and confirms the terms and conditions of employment, must be implemented in the workplace. This will assist the employer in limiting future disputes through proactive management. The employment contract is also one of the key elements the Department of Employment and Labour investigates during inspections.

It is crucial that the employer determines which type of contract to conclude with the employee, taking into account the operational requirements of the company. There are two types of contracts, namely permanent and temporary.

8.2.1 Permanent contract

The following must be noted when electing to use a permanent contract (see 8.3):

- A permanent contract has a start date but no end date.
- If an employee is employed for longer than three months, without there being a justifiable reason stipulated in the employment agreement, the employee will be considered a permanent employee until the contrary is proven.
- A permanent contract may be subject to a trial period. If an employer is not satisfied with an employee's performance, the correct procedures must be followed before an employee is dismissed during or after the expiry of a trial period.

8.2.2 Temporary contract

A temporary contract should not differ from a permanent contract, except for the

term of employment. There are two types of temporary contracts: a fixed-term and a project-based contract. With any temporary contract, the employee must still be given statutory notice before his or her services are terminated.

The following should be considered with each of these contracts:

8.2.2.1 Fixed-term contract

The start and end date of the contract must be stipulated. As a rule, a fixed-term contract may only be in place for a period of three months. However, specific exceptions apply to a contract that exceeds three months: There must be a justifiable reason, and this reason must be stipulated in the employment contract.

> Train people well enough so they can leave; treat them well enough so they don't want to. – Sir Richard Branson

Examples include:

- The employee replaces another employee who is temporarily absent from work.
- The employee was employed due to a temporary increase in the volume of work (this work is not expected to last longer than 12 months).
- The employee is employed to perform seasonal work.
- The employee has already reached the normal retirement age in the workplace.

8.2.2.2 Project-based contract

In terms of a project-based contract, the employee is only employed until the completion of a certain project. The project will have a start date but, at the time of concluding the contract, the project's end date is not yet known. In this case, the employment agreement must stipulate that the employee will perform services up to and including the completion of a project. The contract must also include specifics pertaining to the type of project. The contract will expire once the project is completed.

8.2.3 Proper administration is crucial

Once the employer has decided what type of contract to offer the employee, all the employee's personal details and information must be included in the contract before the employee receives it. The contract must also be discussed with the employee in the presence of a witness, and a copy of the contract given to the employee.

Not only are the details of employment required by legislation; it also regulates the terms and conditions of employment between an employer and employee. This is the foundation of the working relationship between the parties and by confirming this in writing in the employment agreement, uncertainties and potential friction are reduced.

8.2.4 Employee versus independent contractor

It is especially important to distinguish between an employee and an independent contractor. The latter is appointed to perform work or provide a specific service to another person or business. They are not employees of the employer as they perform the work under their own business and is regarded as a service provider.

Furthermore, the independent contractor is not obligated to perform the work him- or herself and may make use of assistants or employees to assist or perform the work.

An employee, on the other hand, is defined in the *Basic Conditions of Employment Act* or *BCEA* as any person, excluding an independent contractor, who works for another person or for the state and who receives, or is entitled to receive, any remuneration; and any other person who in any manner assists in carrying on or conducting the business of an employer.

Labour law governs the employment relationship, protecting the employee and not the independent contractor. Independent contractors need to approach the civil courts if there is a dispute regarding the contract/agreement, work done, payment, etc.

8.2.5 What the law stipulates

Labour law stipulates that, until the contrary is proven, a person who works for or renders services to any other person is presumed, regardless of the form of the contract, to be an employee if any one or more of the following factors are present:

- The way the person works is subject to the control or direction of another person.
- The person's hours of work are subject to the control or direction of another person.
- In the case of a person who works for an organisation, the person forms part of that organisation.
- The person has worked for that other person for an average of at least 40 hours per month over the last three months.
- The person is economically dependent on the other person for whom he or she works or renders services.
- The person is provided with tools of trade or work equipment by the other person.
- The person only works for or renders services to one person.

SOURCES

- Scriven, A. 2024. Contract of employment: Which one to use?
- Scriven, A. 2024. Employee versus independent contractor.

8.3 FEATURES OF A VALID EMPLOYMENT CONTRACT

According to the *BCEA* and *Sectoral Determination 13 (SD13)* for the agricultural sector, incorporated under the *BCEA*, an employer must provide the following details in writing to the employee upon commencement of his or her employment:

- Full name and address of the employer.
- Name of the employee, as well as a job title or brief description of the work for which the employee is employed.
- Physical workplace. If the employee is required or permitted to work from multiple locations, it must be specified as such.
- Date on which employment started.
- Employee's normal hours of work and working days.
- Employee's wages or the rate and method of calculating such wages.
- Rate of payment for overtime work.
- Any other cash payments to which the employee is entitled.
- Any food or accommodation payment to which the farm worker will be entitled and the value of that food or accommodation as calculated in terms of the relevant clauses of *SD13*.
- Details of any payment in kind (goods or services) and the value thereof.
- Frequency by which remuneration will be paid.
- Any deductions to be made from the employee's remuneration.
- Leave that the employee is entitled to.
- Notice period required upon termination of employment, or if employment is for a set period, the date on which employment will end.
- Description of any bargaining council or sectoral determination covering the employer's business.
- Any period of service with a previous employer that counts towards the employee's period of service.
- List of any other documents that are part of the employment contract, with reference to where the employee can obtain a copy of each.

In addition to a written employment contract ensuring that the employer complies with all legal requirements provided in the *BCEA*, it also serves as physical proof of the terms of service that have been agreed upon.

Regarding the terms of service, certain minimum provisions must be followed, regardless of whether the parties are willing to agree to less advantageous terms. If an employment contract contains provisions that do not comply with the minimum terms of service as set out in the *BCEA*, *SD13* or main collective agreement in the case of a bargaining council, these provisions will be invalid and unenforceable.

8.3.1 Probationary period

Another important aspect that should be part of an employment contract is whether the employee's employment is subject to a probationary period. If the employment contract does not contain any provisions regarding a probationary period, an employee's employment will not be subject to it.

The decision to include a probationary period in an employment contract is

not stipulated by law but rests with the employer and employee. This is an example of a condition of employment that the parties to an employment contract can voluntarily agree on. If the employee's employment is subject to a probationary period, certain legal requirements apply.

An employee's main duties and responsibilities must also be clearly stipulated in the employment contract. The employee's duties and responsibilities, as set out in the employment contract, serves as the basis for the evaluation of his or her work performance. If the employment contract makes no mention of the employee's duties and responsibilities, an employee's work performance cannot be evaluated effectively.

SOURCE

- Pretorius, J. 2025. Features of a valid employment contract.

8.4 FIXED-TERM CONTRACTS

The *BCEA* and *SD13* dictates the minimum employment conditions that an employer and employee can agree upon. Take note that labour legislation applies to all employers and employees, irrespective of how the employment relationship is recorded, or the term thereof.

Employers often make four common mistakes when it comes to fixed-term contracts:

Mistake 1: No written employment contract

One of the biggest mistakes employers make is not implementing written employment contracts or settling for a generic employment contract that offers minimal protection when there is a dispute in the workplace.

The employee is employed from the moment he or she accepts employment, irrespective of how the relationship is recorded – via an oral or written agreement. A written agreement (employment contract), however, creates clarity by confirming the terms and conditions of employment agreed upon and protects the employer in terms of the employment relationship going forward.

Mistake 2: Disguising permanent employment

Unfortunately, it does happen that employers attempt to evade the statutory obligations in terms of labour legislation altogether or attempt to evade permanent employment by employing people on a fixed-term basis. This is, however, a grave mistake and employers must clearly understand that to disguise what is in fact permanent employment in the form of a fixed-term contract is illegal.

Ask yourself: Is the position of a permanent/indefinite nature; or is the position of a temporary nature for a specific period or for a specific project? Employees employed on a fixed-term basis for longer than three months will be deemed to be permanent, unless the longer fixed-term period is justifiable in terms of the *Labour Relations Act (LRA)*.

Mistake 3: Creating an expectation

The employer must be careful not to create an expectation of permanent employment with the employee, which can easily happen when a fixed-term employment contract is renewed for a second or third (similar) period.

The more frequently an employer rolls over a fixed-term contract, the more reasonable the employee's expectation becomes that it will continue to be rolled over in the future, thus creating an expectation of permanent employment. Failing to renew such a contract can then be seen as an unfair dismissal.

If a fixed-term employment contract ends and the employee remains in this position, legislation states that such an employee will be regarded as permanent. This means that the contract will be deemed to have been tacitly renewed on the same terms, except that the relationship will now be of a permanent duration.

Mistake 4: Different terms and rules

It is a myth that the same legislation, discipline, policies, and procedures do not apply in the same way to fixed-term employees as it does to permanent employees. The only difference between a fixed-term and a permanent employee is the term of employment.

Fixed-term employees must be treated the same as permanent employees regarding wages, leave and other benefits. Employees on fixed-term contracts must also be given equal access to opportunities to apply for vacancies and is entitled to severance pay upon termination of employment when he/she is employed on a fixed-term contract exceeding 24 months.

SOURCE

- Els, M. 2023. Four mistakes with fixed-term contracts.

8.5 SECTORAL DETERMINATION 13

South Africa's labour legislation is highly regulated, creating a challenging environment for employers. This section provides a summary of the basic rights of employees earning below the earnings threshold, as provided for by the *BCEA*, as amended.

8.5.1 Normal working hours

No employee may work more than 45 normal hours per week. Furthermore, an employee may not be required to work more than nine normal hours per day for a five-day week, or more than eight normal hours for a six-day or more week.

8.5.2 Overtime

Overtime is limited to ten hours per week, and no more than three hours per day. Payment for overtime is one and a half times the employee's normal hourly rate.

8.5.3 Meal intervals

Employees must be granted a 60-minute meal interval after five consecutive working hours, which can be reduced to 30 minutes by agreement.

8.5.4 Work on a Sunday

If a Sunday is a normal working day, the employee must be paid at one and a half times the normal hourly rate. There must be a written agreement to this effect, usually in the employee's contract. If a Sunday is not a normal working day, and the employee is required to work on a Sunday, he/she must be paid double the normal hourly rate.

8.5.5 Public holidays

If a public holiday falls on a day on which the employee would normally work, an employer must pay:

- Employees who do not work on the public holiday at least their ordinary daily wage.
- Employees who do work on the public holiday, at least double the daily wage or their normal daily wage, plus an hourly rate for the actual hours worked, whichever is the greatest.

If an employee works on a public holiday and he/she normally would not work on this day, the employer must pay him/her an amount equal to his/her daily wage plus hourly wage for each hour worked on the public holiday.

8.5.6 Leave

- An employee is entitled to 21 consecutive days of paid annual leave per cycle, or the parties can agree that annual leave will be calculated at one day's paid leave for every 17 days worked.
- An employee is entitled to six weeks of paid sick leave during each three-year cycle. In the first six months an employee is entitled to one day's paid sick leave for every 26 days worked.
- An employee employed for more than four months, and working at least four days per week is entitled to three days of paid family responsibility leave per year when the employee's child is sick or the employee's spouse, life partner, parents, adoptive parents, grandparents, child, adoptive child, grandchild, or sibling passed away.
- A pregnant employee is entitled to four consecutive months' *unpaid maternity leave* and can submit a claim to the Unemployment Insurance Fund (UIF).
- The employee is entitled to ten consecutive days of *unpaid parental leave* at the birth of a child and can submit a claim to the UIF. (Note that an employee who is taking maternity leave cannot also take parental leave).
- An employee who adopts a child aged two years or younger is entitled to ten consecutive weeks of *unpaid adoption leave* and can claim UIF.
- An employee whose child is born through surrogacy is entitled to ten consecutive weeks of *unpaid commissioned parental leave* and can claim UIF.

8.5.7 Retirement age

Retirement age is not prescribed by law. Employers are encouraged to determine the applicable retirement age and include it in the employment contract or a policy.

8.5.8 Rest periods and remuneration

One of the primary aspects of *SD13* relates to minimum rest periods for farm workers, which are essential for their health and wellbeing. Employers have a legal obligation to ensure that workers have enough time in which to rest between work sessions. Four key aspects to consider regarding the regulation of working time are normal working hours, overtime, meal breaks and rest periods.

SD13 stipulates that a farm worker is entitled to a one-hour meal break after five hours of continuous work. This break may be shortened to 30 minutes if a written agreement is in place.

Employees are not remunerated for meal break periods but must receive compensation if he/she is expected to work through their lunch break if, for example, there are no other employees who can do the work, and the work cannot wait until after the lunch break. The employee must also receive compensation if he/she is expected to work during a break exceeding 75 minutes, except if he/she resides on the farm.

SD13 also contains prescriptions relating to a daily rest period; in this regard, an employee gets at least 12 continuous hours of rest between shifts – if agreed upon, this period may be shortened to ten hours, provided the employee has a three-hour meal break and resides on the farm.

Likewise, the employer is required to give his/her farm workers 36 continuous hours per week off in which to rest, or alternatively a rest period of 60 continuous hours off every second week, if agreed upon. The rest period must include a Sunday unless both parties agree otherwise.

In addition to the previously mentioned practices, legislation does provide for other allocations of working hours for farm workers. For instance, it provides for the extension of normal working hours

for workers, compressed working weeks, as well as an option allowing employers to apply for temporary exemption from the application of certain sections of the legislation.

Each of the options has advantages, disadvantages, and specific requirements. Employers are therefore advised to consult with a legal expert who can assist them in planning the work hours of their business based on the required legal directives.

SOURCES
- Swart, C. 2025. *Sectoral Determination 13* in a nutshell.
- Latsky, H. 2024. Working hours and rest periods on South African farms.

8.6 UNEMPLOYMENT INSURANCE

The aim of the *Unemployment Insurance Act, 2001 (Act 63 of 2001)*, as amended, is to establish an Unemployment Insurance Fund (UIF). Employers and employees contribute to the fund and employees who become unemployed, or their beneficiaries where this may be the case, may be entitled to benefits.

This system seeks to alleviate the harmful economic and social consequences of unemployment, which can have a major impact on individuals and families. Therefore, the *Act*, by way of a structured and collaborative approach, helps to create a network of support that can assist those in need.

8.6.1 Application of the *Act*

The *Act* applies to all employers and employees; however, some categories are not included in the provisions of the *Act*, such as employees who work for an employer for less than 24 hours a month, members of parliament, cabinet ministers, deputy ministers, members of provincial executive councils, members of provincial legislators, and municipal councillors.

Employers who are obligated to pay unemployment insurance must register with the UIF offices to ensure the payment of contributions. An employer cannot exercise discretion as to whether or not to register for unemployment insurance.

Employers must pay monthly UIF contributions within seven days after the end of the month. To adhere to legislation, the contributions must therefore reach the UIF by the seventh of each month. This is essential to ensure that the UIF has sufficient funding to meet the requirements of unemployed employees. These contributions comprise 1% of the employee's salary, which is deducted from their salary, and a further 1% contributed by the employer.

8.6.2 Employers' responsibility

Employers play a vital role in the implementation of legislation and must:

- **Register for UIF:** Registration must be completed as soon as the employee's employment commences.
- **Make monthly payments:** This includes deducting 1% from the employee's salary for their contribution along with a 1% contribution by the employer.
- **Submit statements:** Employers must submit a monthly UIF statement to the Department of Employment and Labour. This document contains information regarding UIF contributions for both the employer and employee in respect of each employee.
- **Issue UI forms:** Employees must receive these forms to enable them to claim UIF benefits in the event of unemployment or similar circumstances. The best example of this is the UI-19 form issued when an employee's employment ends and the person does not yet have a new job.
- **Keep records:** Employers must keep accurate records of UIF contributions, employee information, and relevant documentation. This documentation might be subject to audits by the Department of Employment and Labour, and a fine may be issued for non-compliance.

8.6.3 Risk of non-compliance

The relevant legislation sets strict requirements that must be adhered to and any employer found to be in breach of this *Act* may be liable for a fine and/or imprisonment. These guidelines are in place to ensure a high level of compliance and to maintain the integrity of the UIF. It is essential for employers to take their responsibilities seriously to ensure the well-being of employees and their families.

SOURCE

- Botes, T. 2025. The *Unemployment Insurance Act* and the employer's responsibilities.

8.7 MISCONDUCT AND DISCIPLINARY HEARINGS

Dismissal is a critical decision by employers that impacts the business and the lives of employees. The *LRA*, as amended, offers a framework in *Schedule 8: Code of Good Practice: Dismissal* (the *Code*) to ensure fairness. This *Code* outlines important principles to balance justice with the operational needs of businesses, and employers need to take note.

8.7.1 Clear disciplinary rules (code of conduct)

Items 3 and 4 of the *Code* requires employers to establish clear disciplinary rules in the workplace that set the standard of conduct expected from employees. These rules may vary based on the size and nature of the business. The key is ensuring that the rules are easy to understand, fair, and thoroughly communicated to and shared with employees.

Every workplace must have a relevant disciplinary code. It is a clear set of rules with appropriate sanctions that all employees must comply with. If employees contravene these rules, the employer has the right to act.

The employer's responsibilities are to:

- Maintain discipline within the framework of the procedures in a fair, equitable and consistent manner, with an emphasis on progressive discipline.
- Prevent unacceptable behaviour.
- Change unacceptable behaviour through a positive influence.
- Maximise productivity within the workplace.

Disciplinary sanctions provide guidelines for the consistent application of disciplinary action by employers.

Employees must be made aware of the disciplinary code:

- Hold a meeting with all employees or hold smaller group meetings if there are many employees.
- Circulate an attendance register as proof of who attended the meeting.
- Discuss the disciplinary code with employees and highlight the possible consequences of different offences.
- Keep minutes of the meeting as a record.

Disciplinary sanctions provide guidelines for the consistent application of disciplinary action by employers. Progressive discipline is emphasised, as discipline in the workplace aims to adjust and improve behaviour through correction, consultations and warnings rather than punishing or dismissing an employee. Dismissal should always be the last option.

8.7.2 Progressive discipline

The *Code* encourages progressive discipline, reserving dismissal for serious cases and as a matter of last resort. Progressive discipline focusses on guiding employees to meet required standards through measures such as counselling and warnings. An informal discussion is often sufficient for minor infractions, while repeated or more serious misconduct may lead to formal written warnings, or other disciplinary actions short of dismissal. Dismissal is generally reserved for serious misconduct or repeated offences.

Dismissal for a first offence is rare and typically applies only in cases of severe

misconduct that renders continued employment intolerable, such as gross dishonesty, wilful property damage, endangering safety, physical assault, gross insubordination, etc.

When considering dismissal, employers should weigh the seriousness of the misconduct alongside the employee's personal and mitigating circumstances (e.g., length of service and disciplinary record), nature of the job, and context of the offence. Consistency in applying disciplinary actions, both in similar cases and among employees involved in the same incident, is essential to ensure fairness.

8.7.3 Fair or unfair

The *Code* provides that, when determining whether a dismissal for misconduct is unfair, the following should be considered:

- Did the employee contravene a workplace rule or standard?
- Was the rule valid and reasonable?
- Was the employee aware of, or could reasonably have been expected to know about the rule?
- Was the rule consistently applied by the employer?
- Was dismissal an appropriate sanction for the offence.

8.7.4 Fair procedures

Many employers often refer to "immediate dismissals" or similar actions. However, under South African labour law, there is no such thing as a valid on-the-spot "you're fired" dismissal. To ensure fair procedure in dismissal cases, employers should follow a process that includes the following:

- **Investigation:** Investigate to determine whether there are valid grounds for dismissal. This process does not need to be overly formal but should be thorough enough to gather all relevant facts and evidence to support the decision.
- **Notification:** Inform the employee of the allegations by way of a written notice to attend a hearing and explain this to the employee in clear, understandable language and terms.
- **Opportunity to respond:** Allow the employee sufficient time to prepare for the hearing; the opportunity to state their side of the case and respond to the allegations; and the offered option to have assistance or representation, such as their workplace trade union representative (shop steward) or a colleague, to support them during the process.
- **Communicating decisions:** Once the inquiry is complete, communicate the decision clearly and in writing, outlining the reasons behind it. Also remind the employee of his/her right to refer the matter to the Commission for Conciliation, Mediation and Arbitration (CCMA).

Employers should ensure their actions align with the guidelines in Schedule 8 of the *LRA*, balancing operational needs with employee rights. By following the principles outlined in the *Code*, both employers and employees can navigate dismissals with integrity and fairness.

SOURCES
- Botes, T. 2023. The importance of a disciplinary code.
- Louw, M. 2025. Misconduct: To dismiss or not?

8.8 DISMISSAL AND PRESENTING EVIDENCE

During disciplinary and arbitration proceedings, the employer has a responsibility to present evidence to the chairperson or commissioner to prove its case. Evidence is defined as "the available body of facts or information indicating whether a belief or proposition is true or valid". It is thus the proof of the employer's argument and not just the argument itself.

However, employers tend to neglect this responsibility of adducing evidence to acquire, compile, and prepare evidence for the disciplinary hearing or arbitration. This consequently negates the chairperson's ability to conduct the hearing since he/she will need to hear evidence from both sides to make an objective decision regarding the matter. This neglect will also negatively affect the employer's case should the matter be referred to the CCMA.

Evidence presented at hearings must meet the requirements in terms of the law of evidence to be admissible.

8.8.1 Important notes

- Appoint a person qualified to chair disciplinary hearings and who is knowledgeable in both labour law and the law of evidence.
- Evidence presented at hearings must meet the requirements of the law of evidence to be admissible.
- Accused employees should be given the chance to cross examine or dispute evidence presented by the employer.
- If inadmissible evidence is considered when dismissing an employee, the dismissal would be unfair.

Should an employer not introduce or present evidence correctly at disciplinary hearings or arbitrations, it may have dire consequences such as the employee's dismissal being declared unfair. The employee may further be awarded compensation or even reinstated.

It is important that employers deal with issues in the workplace as quickly and effectively as possible, while taking care to act objectively and consistently. By being proactive, the employer can contribute towards the business's sustainability and profitability and ensure a working environment with reduced conflict, friction, and misunderstanding, which in turn creates a structured environment receptive to growth.

8.8.2 CCMA case after dismissal

A dismissed employee can refer a dispute to the CCMA to challenge the fairness of their dismissal. Therefore, prior to dismissal, employers should ensure that they follow the correct procedure and have sufficient grounds for dismissal.

An employee who refers a case to the CCMA becomes the applicant and the employer the respondent. The applicant has 30 calendar days after the date of dismissal to refer a dispute online or in

person to the CCMA. A completed referral form sets out the basis of the claim and is served on the employer and filed with the CCMA.

After the 30-day period has lapsed, the applicant may still refer the matter but must show good cause for the late referral. This is usually done as an application for condonation of the late filing of the referral, which the respondent (employer) can oppose through a written submission. The commissioner dealing with the matter will address the late filing and decide on the outcome.

Upon receipt of the referral form, the CCMA sets the matter down on a date and time that parties need to attend for either a conciliation or a Con-arb process. The CCMA must provide parties with 14 days' written notice of the proceedings in case of a conciliation or Con/arb, and 21 days' written notice in case of an arbitration, with an additional seven days' notice if sent via registered mail.

8.8.3 CCMA processes

- **Conciliation:** The commissioner will attempt to resolve the matter on an informal basis. Conciliation proceedings are private and confidential. No person may refer to anything said during conciliation proceedings in any subsequent proceedings, unless agreed to by the parties in writing or if ordered by a court of law.
- **Arbitration:** A formal hearing where a commissioner will give both parties the opportunity to present their case, including witnesses and evidence. Once concluded, the commissioner has 14 days to make a ruling as to the fairness of the dismissal.
- **Con/arb:** Conciliation and arbitration is heard on the same day. If the matter is not resolved at conciliation, arbitration will follow directly thereafter. Either party can object to arbitration immediately after conciliation in an unfair dismissal dispute by written notice to the CCMA and the other party, no later than seven days prior to the scheduled date.

The respondent (employer) must prove the following at the CCMA:

- **Procedural fairness:** Includes presenting the employee with a notice of disciplinary hearing setting out the charges and allowing the employee reasonable time to prepare for the hearing. At the hearing, the employee may request an interpreter, to be represented, to state his/her case, to call witnesses, to question the evidence of the employer's witnesses, etc. An independent chairperson should then hear the evidence and make a finding on the charge(s).
- **Substantive fairness:** Proof that the employee was guilty of misconduct which was serious enough to warrant a sanction of dismissal in the specific circumstances.

If an employer fails to follow fair procedures, it may result in a CCMA order made against the employer of up to 12 months' salary to the employee. Likewise, if a dismissal is found to be substantively unfair, the CCMA may either order the employee's re-instatement or re-employment, or, if returning to work is not feasible, award the employee compensation.

CCMA processes can be intimidating, and it is a good idea to get expert advice. An employer can be represented by any employee/director of the business, or by an office bearer/official of an employers' organisation that is registered with the Department of Employment and Labour.

SOURCES

- Scriven, A. 2024. CCMA case after employee dismissal.
- Levendal, X. 2025. Importance of presenting evidence correctly.

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