Research letter

The reality of drought, consequences and mitigation strategies for livestock production in South Africa

M.M. Scholtz1,2#, A. Maiwashe1,2, M.A. Magadlela3, T.J. Tjelele1, B.D. Nkosi1 & M. Matabane1

1ARC-Animal Production Institute, Private Bag X2, Irene, 0062, South Africa; 2, Department of Animal, Wildlife and Grassland Sciences, University of the Free State, P.O. Box 339, Bloemfontein, 9300, South Africa; 3Agricultural Research Council, P.O. Box 8783, Pretoria, 0001, South Africa

Abstract

South Africa faced its worst drought in 2015 and as a result the livestock herds and flocks were under severe threat. This drought, linked to the heat waves and the reduction in breeding stock, will result in a shortage of livestock products for the next two to four years. A number of short and long term strategies are briefly discussed, whereas the importance of water is emphasized.

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# Corresponding author: GScholtz@arc.agric.za

The reality

South Africa faced its worst drought in 2015 since 1982. This severe drought was ascribed to the combination of events such as regular climate dynamics, the presence of a super El Nino, and global warming. According to the South African Weather Service 2015 was the driest year since recording of rainfall started in 1904. The average national rainfall in 2015 was approximately 400 mm compared to the long term average of just more than 600 mm. From 2012 to 2015, below average national rainfall was recorded for every year. As can be seen from Figure 1, it was only the third time since 1904 that below average rainfall was recorded in four or more consecutive years, the other two periods being from 1930 to 1933 and from 1944 to 1949.

Figure 1 South Africa’s total annual rainfall (mm) based on provincial rainfall data from 1902 until 2015 (South African Weather Service, 2016)
The 2015 drought was also accompanied by extreme heat and 2015 was the warmest year ever recorded. In Table 1 the number of heat waves and number of days on which heat waves were experienced (October to March) over the last 10 summer seasons are summarized (obtained from a presentation by Engelbrecht, C, unpublished). From Table 1 it can be seen that during the 2015/2016 summer season 12 heat waves, totalling 71 days were experienced.

**Table 1** Number of heat waves and heat wave days (October to March) over the last 10 summer seasons (obtained from a presentation by Engelbrecht, C, unpublished)

<table>
<thead>
<tr>
<th>Season</th>
<th>Number of heat waves</th>
<th>Number of “heat wave days”</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006/2007</td>
<td>6</td>
<td>21</td>
</tr>
<tr>
<td>2007/2008</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2008/2009</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>2009/2010</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>2010/2011</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>2011/2012</td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>2012/2013</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>2013/2014</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>2014/2015</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>2015/2016</td>
<td>12</td>
<td>71</td>
</tr>
</tbody>
</table>

Projections show that in South Africa the interior temperature will rise by 2 to 3 °C by 2050 (Department of Environmental Affairs, 2010) and by 4 to 7 °C by the end of the century, if the release of greenhouse gases is not contained (Engelbrecht, et al., 2015). Furthermore, the rainfall will be much more variable (Lennard, et al., 2016).

**Consequences**

Thousands of livestock have died or been culled due to the drought during the 2015 – 2016 season. Some farmers auctioned their livestock before they died and nearly a third more animals were slaughtered compared to the same time in 2014, mainly because of the drought. It is clear that South Africa’s livestock were under severe feed and heat stress during the latter part of 2015 and this will affect livestock production in the years to come. The net result of the drought, linked to the heat waves and the reduction in breeding stock, will be a shortage of livestock products for the next two to four years.

Starving animals will mostly display pica behaviour. Rural communities should therefore be encouraged not to litter, especially with plastics to prevent the deaths of animals that could have otherwise been saved by providing feed supplements. The use of degradable, plant (cellulose) based packaging (bags, containers, nappies) should also be enabled/promoted/encouraged.

In the case of especially beef cattle, the fertility of the bulls may have been compromised. Heat stress is a common cause of reproductive inefficiency in mammals. Semen quality decreases when bulls are continually exposed to high ambient temperatures. Furthermore, it decreases sperm concentration, lowers sperm motility and increases percentage of morphologically abnormal sperm in an ejaculate. After a period of heat stress, semen quality does not return to normal for approximately eight weeks because of the length of the spermatoc cycle, adding to the carry-over effect of heat stress on reproduction. It is important to note that only one day of heat stress may reduce semen quality and potential fertility.

If bulls cannot increase the rate of heat loss from the body when they are exposed to elevated ambient temperatures, semen quality and potential fertility are therefore reduced. It is important to note that in the South African beef production programs, eight weeks is essential for restoration of normal quality semen production after bulls are exposed to elevated ambient temperatures that cause heat stress, especially where fixed summer mating seasons are practised.
Short-term mitigation strategies

A number of possible short term mitigation strategies are listed below.

i) During seasons of heat stress, a solution may be to make use of multi-sire breeding and/or to use of bulls from tropical adapted genotypes, to mitigate possible male infertility.

ii) Introduction of alternative, more drought resistant crops which can provide grain sources for basal animal feeds such as sorghum. These alternative grains may be used in different forms of silage or balanced rations.

iii) Reduce animal numbers in order to manage stocking rates. This suggestion is easier to implement for both commercial and small holder farmers on privately-owned land, but rather difficult for livestock owners on communal land where decision-making regarding reducing stock numbers involves many owners who may not easily agree to the idea. The campaign to reduce stock numbers could be carried out jointly with government drought relief programmes (supply of feeds) where farmers could be required to agree to reduce stock numbers for eligibility to participate in such programmes.

iv) Every possible source of hay counts in this situation and the possibility of ammonization of some poor quality hay could be considered. For example, 27 kg of anhydrous ammonia per ton of straw will increase livestock performance and make it possible to use wheat straw as the only roughage in the diet, a practice that is not recommended for untreated straw.

v) Poor quality hay from across South Africa could pose a threat in the dispersal of weeds in grazing lands. To reduce chances of introducing undesirable plant species that may come with purchased fodder, feeding must be restricted to specific locations on the farm.

vi) Consider feeding alternative feeds, like shredded scrub (boskos). This implies that bushes and the smaller branches of trees are shredded and used as animal feed. Livestock can eat other feedstuff than just hay. In fact, they will do well on many other types of feed such as shredded scrub.

vii) Since the drought is normally compounded by extreme heat, taking into consideration that hide texture and hair colour impacts on animal thermal regulation and heat stress, farmers need to make sure that their livestock have access to water and shade.

viii) Livestock movement needs to be restricted, particular during the hot periods of the day. In addition, the movement of livestock when providing drought feed should be restricted as far as possible, since livestock that is allowed to move about a lot will spend more energy, which is not productive and it places a burden on maintenance requirements.

ix) Provide feed at night during extreme heat periods Livestock tend to consume more feed during the night during periods of heat. It is therefore important to ensure there is feed available during the night.

x) Control parasites and provide the same salt and mineral mixture during drought as during normal periods. Cattle under nutritional and heat stress are less resistant to parasites than under normal conditions.

xi) The social awareness of droughts as well as its effects and countermeasures should be improved. This can be done through training, brochures, leaflets, bulletins, internet, radio, television, newspapers, etc.

Long term strategies

It is also important to develop long term strategies, since the indications are there that South Africa will experience more extreme and variable climates as a result of global warming. Some of the possible long term strategies are briefly discussed below.

The planting of drought tolerant crops

Some of the drought fodder crops that can be considered for South Africa going into the future are oldman saltbush (Atriplex nummularia), spineless cactus (Opuntia spp.) and American aloe (Agave americana). They have relatively low water requirement per kilogram of dry matter produced.

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**Alternative fodder production systems**

The feasibility of using “hydroponics,” also referred to as contained feeding systems, should be investigated as an alternative way to produce fodder in periods of drought. The University of the Free State is already busy with a review in this respect.

**The development of pastoral risk management and decision support systems.**

Management and decision-making by livestock farmers would be greatly enhanced by the availability of risk identification/evaluation and decision support systems; or early warning systems. The provision and development of databases based on sound research results should provide the necessary inputs for the development of risk management and decision support tools. This should include decision support tools whereby the stock farmer can be informed in time of environmental risks (e.g. drought and/or floods) and extreme events (e.g. temperature (both high and low), so that the farmer can employ strategies to minimize the negative effects.

**Breeding for animals and forage cultivars that are more drought tolerance**

Breeding strategies should be implemented for selection and breeding South Africa’s indigenous breeds to enhance their capacity to tolerate drought. In the case of Afrikaner, for example, it developed in the drier areas and it has specific adaptive traits. The Nguni breed is known to be adapted to low input production systems. The breeding of indigenous livestock in government and research farms should be encouraged with the aim of distributing them to farmers. Research should also focus on breeding of drought tolerant animals using the latest genomics technology. Identification of genetic markers and genes for drought tolerance will be key in ensuring that this strategy is successful.

New forage, pasture cultivars and eco-vars with higher nutritive quality and tolerances to limiting conditions (low soil fertility, drought and low water availability, heat stress, etc.) and competition from other plants (weeds and mixtures), are needed to optimise the efficiency of utilisation of veld by livestock.

**Veld monitoring and management**

Environmentally sound management of livestock on different veld types is fundamental to sustainable livestock production. Veld monitoring and management systems are needed to help pastoralists maximise economic efficiencies in livestock production while avoiding negative impacts of severe droughts.

**Climate change**

More efforts should be devoted to research on climate change and its impact of livestock production so that appropriate mitigation strategies (i.e. nutritional/ration adaptations to reduce heat load) could be developed and implemented. One initiative would be to develop projections of future changes in heat stress in cattle under climate change, as well as medium-range and seasonal prediction models for heat stress in cattle as an early warning system for farmers based on the temperature-humidity index, an internationally used parameter indicative of heat stress in animals.

**Sustainable drought relief strategies e.g. fodder bank establishment**

It is important that farmers develop sustainable drought relief strategies, since the indications are there that South Africa will experience more extreme and variable climates as a result of global warming. Fodder flow planning with alternative methods of feed preservation strategies also need to be developed/transfered to livestock farmers. This will help to relinquish farmers’ dependency on government fodder-provision schemes or subsidies.

**The importance of water**

During times of drought there is in most cases also periods of heat stress. Heat stress can affect the way livestock consumes feed (more night feeding) and the amount of water it is consuming, which can drastically increase. Water is used by livestock to regulate body temperature, by exhaling warm moisture laden air from the lungs (sheep cool down this way as they can’t sweat).
Through the water that is lost by exhaling (sheep and cattle) or sweating (cattle) essential minerals are lost to the animal. These lost minerals will further exacerbate the situation and create a downward spiral (reduced production). It is therefore important that sufficient water is provided during hot periods, with the necessary mineral supplementation.

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References