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Maize prices in South Africa: Can the producer increase his revenue by  
marketing grain through cattle?

By

Maré, F.A.; Nell, W.T.; & Willemse, B.J.

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# **Maize prices in South Africa: Can the producer increase his revenue by marketing grain through cattle?**

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# **Maize prices in South Africa: Can the producer increase his revenue by marketing grain through cattle?**

## **Abstract**

*Since the decline in the price of maize from the beginning of 2010, meat has become the new buzzword under maize producers as they are desperately looking for alternatives to increase the value of their crops. It seems as if the price of maize may stay low at levels equal to export parity prices for the next year or two due to very large yields and an increasing level of ending stocks each year. On the other hand, there is the meat sector which is doing extremely well and had even shown positive growth during the worldwide financial crisis. A substantial decrease in the price of beef therefore seems unlikely and makes it a very attractive alternative market for maize. The question, however, is whether the value of maize can be increased by marketing it through beef, and what factors influence the profitability of this marketing alternative. A model simulating different scenarios with regards to the physical and financial information of a feedlot indicates that in the most cases a feedlot will have a positive margin and thus increases the value of the maize that is fed. The factors that were found to affect the margin the most in a negatively correlated relation, are the weaner price, maize price, feed conversion ratio, mortality rate and feed concentrate price, while those affecting the margin in a positively correlated way are the carcass price, slaughter percentage and average daily gain.*

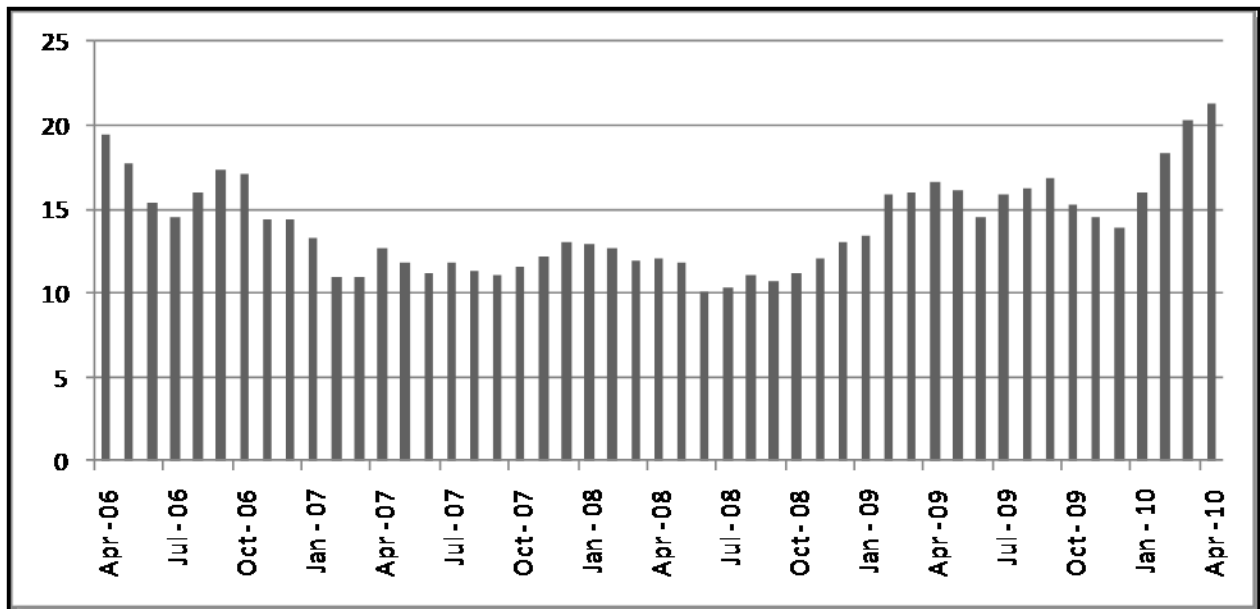
## **1. Introduction**

Since the maize price in South Africa started to decline at the beginning of 2010 as a result of a near record crop, maize producers realised that they were facing problems to cover input costs. The reasons for the significant and relative fast decline in maize prices will be discussed at a later stage. This situation leads to a scenario where the producers of maize are looking for alternative marketing methods in order to add value and obtain higher prices for their products. Although there are alternative marketing options available to producers that can be used to obtain a higher price for their crops, the success of these options is difficult to determine.

One of these options, for example, is an export pool that Grain SA wants to administer to isolate approximately 3 million ton of maize for the export market, to move the price on the domestic usage part of the crop towards a higher price level than export price level (Laubscher, 2010). Although the export of this maize may influence the price of the next crop, the transaction will take place at the current maize price and producers, with a low yield per hectare, may have to sell their crops at prices that will barely cover production costs. Van Rooyen (2010) suggested that the issue regarding low maize prices in South Africa may change if local markets can be developed for the local maize and oilseed production. One of these markets is the bio-fuel market which will not only use the oversupply of maize,

but will contribute significantly to the fuel needs of the country. Bio-fuel production will also supply the markets with useful by-products such as DDGS, which can be used as a protein feed for livestock, and CO<sub>2</sub> gas. Although the bio-fuel concept in South Africa looks very appetising, taking in mind the almost 105 000 work opportunities it will create, the Government had decided that maize may not be used for ethanol production due to the fact that it is a staple food (Van Rooyen, 2010).

The questions thus arise as to what else a producer can do to increase the value of a maize crop? With the low maize (animal feed) price and relatively high meat prices, the idea to market grain through livestock to increase value, remains a possibility. From Figure 1 it is clear that the ratio of the maize price relative to the meat price (corn/beef ratio) has increased significantly over the past three years.



Source: Willemse (2010)

**Figure 1: Ratio between the price of maize and class A beef.**

The increase in the ratio between the price of maize and beef may create hope for maize producers considering the feeding of cattle. However, is it the only factor that must be taken into consideration when a decision is made on the marketing of maize through feed? This paper will focus on the profitability of a maize producer using his maize for feeding cattle in a feedlot, rather than to sell at the current maize price in the market, taking into account some of the factors that will influence the profitability of such an enterprise.

## 1.1 The South African maize sector and prices

The South African maize market is characterised by a larger supply than what can be used locally or exported in the current marketing year in South Africa. Although one of the largest maize crops in the history of South African farming will be harvested in 2010, farmers struggle with prices. The Crop Estimation Committee is estimating the current maize crop on 13.3 million ton (May 2010). Given carry

over stock from the previous season and domestic usage of 10 million ton, a surplus above domestic usage of 5 million ton is available. Domestic export capacity is estimated at a maximum of 2.5 million ton per year. The strengthening value of the rand against the US dollar also adds to a lower export price that producers are receiving (CEC, 2010). High production costs during the planting season will make it almost impossible for farmers with low yields per hectare to realise any profits (Willemse, 2010).

To understand the current scenario, it is necessary to look at more specific figures regarding maize production and price as well as the exchange rate. As indicated, and from Figure 2, it is evident that the R/\$ exchange rate strengthened significantly and have reached levels of around R7,50/\$, following a steady rate of strengthening from the peak of R11,55/\$ in October 2008. The strengthening of the Rand was caused by the financial crisis, with its origin in the US financial sector, which resulted in a realignment of exchange rates in most countries. With the current uncertainty about sovereign defaults, starting with Greece and impacting on the European economies and currencies, the outlook for further currency realignments will result in further maize price volatility in South Africa.



Source: JSE (2010)

**Figure 2: R/\$ exchange rate for 2008 - 2010.**

The demand and supply for maize in South Africa from 2006/07 to 2008/09 in realised figures and 2009/10 to 2010/11 as estimations are presented in Table 1. With a carry over stock of almost 1.13 million ton from the 2008/09 season and an estimated yield of 13.1 million ton, and yellow maize imports of 27 000 ton for the 2009/10 season, there are a total commercial supply of almost 14.7 million ton available. The increase of 1.7 million ton in supply is larger than the 200 000 ton increase in domestic demand, and ending stocks will thus close with 1.5 million ton more this year (April 2010). The estimate for the 2010/11 marketing year suggests that the trend of very good yields may continue and a further built-up in carry over stock may take place (taking exports into account).

Since the first crop estimate in 2010, the market realised that a large crop was on hand and the price of maize to be dropped significantly from levels of about R1 650 per ton to R1 100 per ton in about six weeks. Figure 3 shows the maize spot price of maize futures contracts on the JSE and indicates that the price of maize in general has stabilised at just above R1 000 per ton, which is equal to export parity price (Randfontein basis).

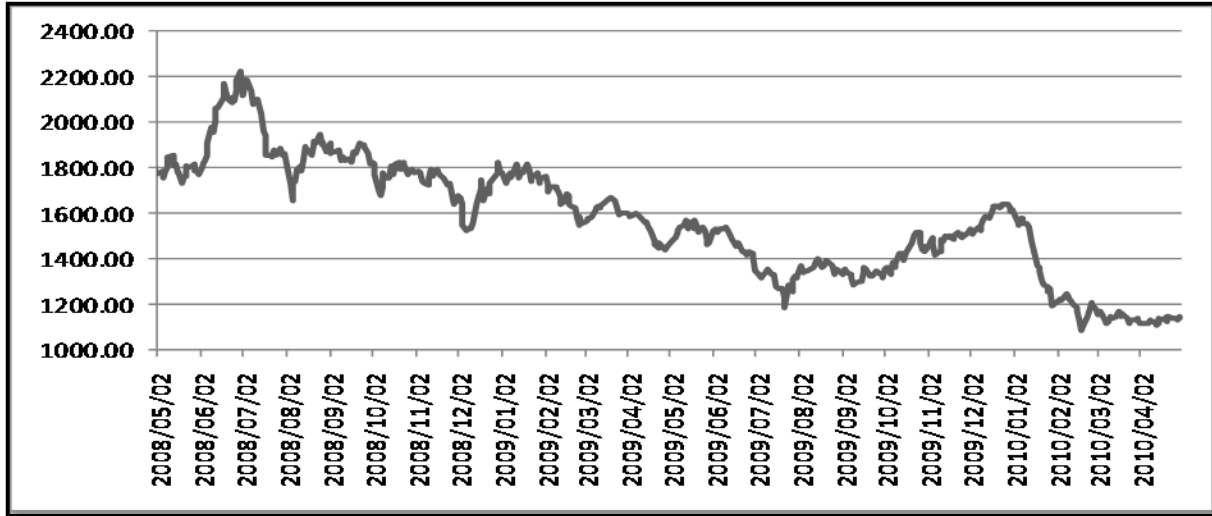
The low maize price that producers are experiencing, together with the scenario that the maize price will remain low due to large future crops, are motivating producers of maize to search for alternative ways to market their crops and improve income per hectare.

**Table 1: Supply and demand of maize (white and yellow) in South Africa.**

	SAGIS			Grain SA	
	2006/07 ('000 ton)	2007/08 ('000 ton)	2008/09 ('000 ton)	2009/10* ('000 ton)	2010/11* ('000 ton)
<b>Commercial supply</b>	4.25 t/ha	2.70 t/ha	4.25 t/ha	4.79 t/ha	4.86 t/ha
Opening stocks (1 May )	3 169	2 070	1 049	1 581	2 203
Commercial production	6 707	6 884	11 891	11 633	13 317
Imports	930	1 120	27	27	0
<b>Total commercial supply</b>	<b>10 806</b>	<b>10 074</b>	<b>12 967</b>	<b>13 241</b>	<b>15 520</b>
<b>Commercial demand</b>					
<b>Commercial consumption</b>					
Food	4 008	3 985	4 743	4 608	4 700
Feed	4 047	4 429	4 284	4 590	4 700
<b>Total</b>	<b>8 055</b>	<b>8 414</b>	<b>9 027</b>	<b>9 198</b>	<b>9 400</b>
<b>On-farm consumption</b>					
Gristing	81	63	69	82	85
Other ( including unexplained residual)	3	15	20	- 30	520
<b>Total</b>	<b>84</b>	<b>78</b>	<b>89</b>	<b>52</b>	<b>605</b>
<b>Total RSA consumption (commercial)</b>	<b>8 139</b>	<b>8 492</b>	<b>9 116</b>	<b>9 250</b>	<b>10 005</b>
<b>Exports</b>					
Products	49	61	104	122	98
Whole maize	548	472	2 162	1 666	1 940
<b>Total</b>	<b>597</b>	<b>533</b>	<b>2 266</b>	<b>1 788</b>	<b>2 038</b>
<b>Total commercial demand</b>	<b>8 736</b>	<b>9 025</b>	<b>11 382</b>	<b>11 038</b>	<b>12 043</b>
<b>Carry-out (30 April)</b>	<b>2 070</b>	<b>1 049</b>	<b>1 585</b>	<b>2 203</b>	<b>3 477</b>
<b>Pipeline requirements</b>	<b>1 007</b>	<b>1 052</b>	<b>1 128</b>	<b>1 150</b>	<b>1 175</b>

\* Estimations

Source: Grain SA (2010)



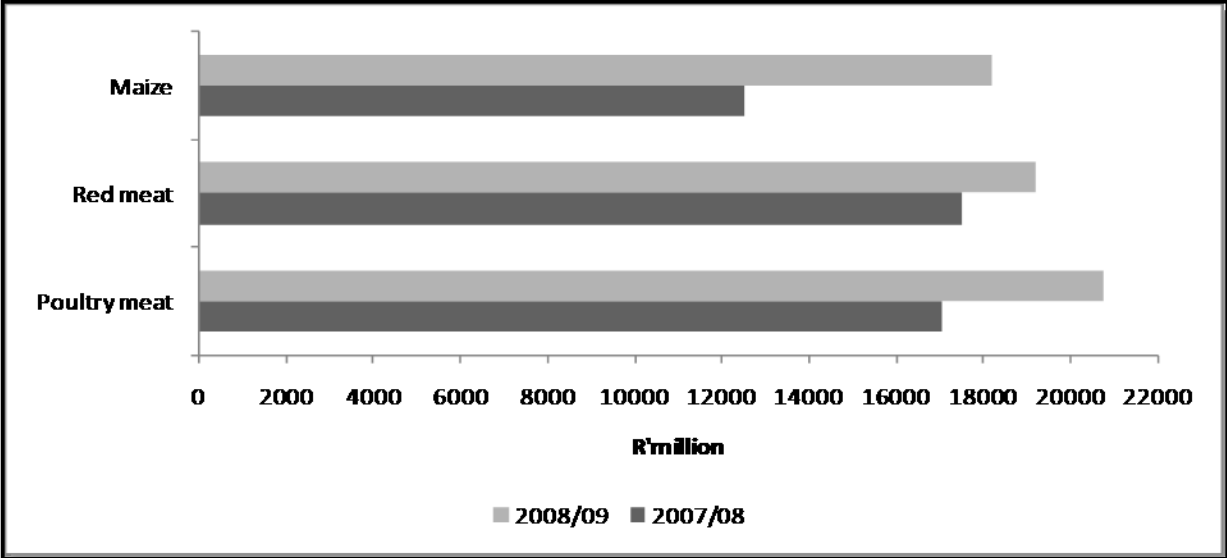
Source: JSE (2010)

Figure 3: Spot price of maize (average of white and yellow) futures contract on JSE (R/ton).



## 1.2 The South African beef sector and prices

The gross value of South African agricultural production was calculated on R124 463 million in 2008/2009 (DAFF, 2009). Animal products, field crops and horticulture products respectively contributed 48.2%, 26.7% and 25.1% to the above mentioned figure. Taking a look at industries it can be seen that the poultry industry made the largest contribution with 16.7%, while cattle and weaners slaughtered contributed 10.6%. Although the contribution of slaughtered beef seems to be low, it must be kept in mind that this sector is solely responsible for more than a tenth of the total gross value of agricultural production. The gross income for the three major agricultural products is presented in Figure 4. Although red meat had lost its first place to poultry from 2007/2008 to 2008/2009, it still is the second largest contributor, with maize in the third place. Red meat production is thus a large sector in the South African agricultural context, and its value is still increasing over time.

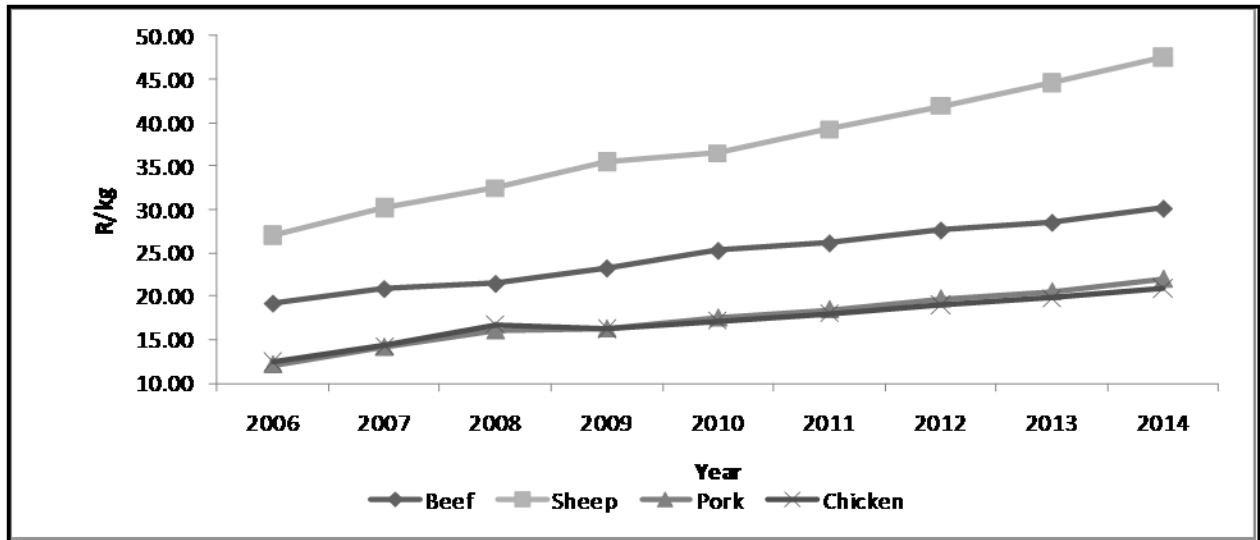


Source: DAFF (2009)

**Figure 4: Gross income from major agricultural products.**

The market and price outlook for beef in South African agriculture seems to be quite good. The Bureau for Food and Agricultural Policy (2009) indicates in its baseline that the prices for all meat types will increase over the next five years (Figure 5). Despite the economic recession during 2008/09, the price of meat has increase between 8% and 15% in 2008. The price of mutton is expected to steadily increase over the next five years, while the price for beef, pork and chicken may follow a cyclical upward trend influenced by feed prices. The effect of the 2010 Soccer World Cup on meat demand may not be big and an increase in demand of only 2 636 ton is expected. This can lead to an increase in prices only for a short period and may not influence the average prices for 2010. It is expected that the total production

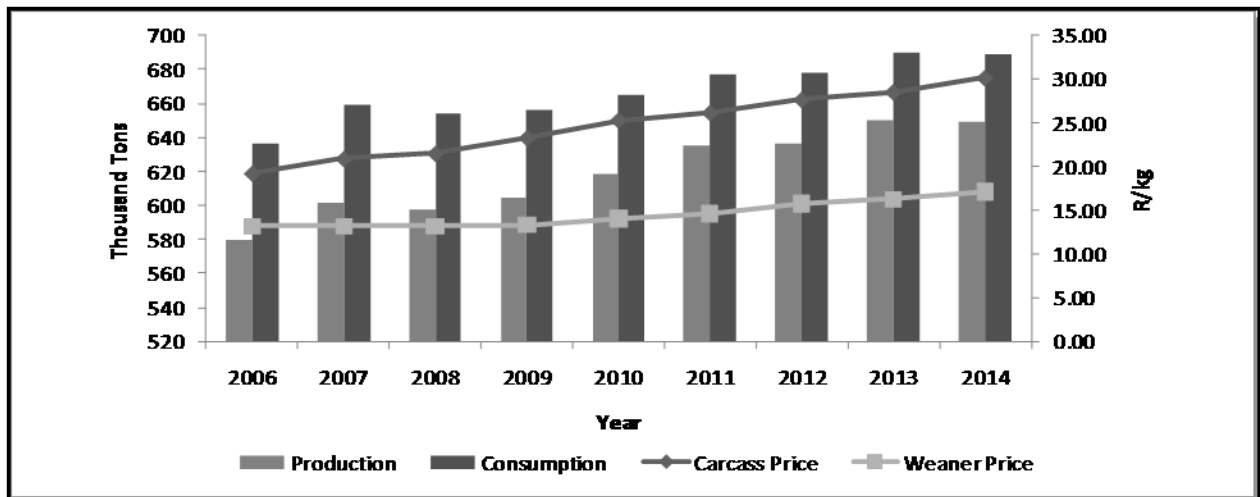
of meat could increase with 8% over the next five years, while demand could increase with 11%, leaving South Africa as a net importer of meat.



Source: BFAP (2009)

**Figure 5: South African meat prices.**

The production of beef remained fairly constant over the period 2008-2009 (Figure 6) on the back of high feed costs. Lower feed prices in 2009 and 2010 are expected to simulate production from 2010 onwards. The expected softening of beef demand during 2008/09, with the economic downturn, has not materialised. However, the restaurant and take-away industries have been negatively affected by the tendency of consumers to buy fresh meat for home entertainment. As the economy recovers, beef consumption is projected to grow at a moderate rate due to projected growth in personal disposable income of the South African population. The gap between beef and weaner prices is expected to widen due to possible higher feed costs in the future. This may result in a decline of profit for the farmer who sells his calves as weaners to the feedlot industry.



Source: BFAP (2009)

**Figure 6: Beef production, consumption and price.**

According to the demand, supply and price of beef it seems as if the beef industry will continue on a positive trend for the producers of beef in South Africa. One of the reasons for the positive future of this commodity is the fact that the price of beef continued to increase even through the economic recession.

## 2. Previous research on feedlot profitability

The feeding of maize cattle became a practice after World War II when feedlots started using the post-war oversupply of grain for cattle feed (McCluskey, Wahl, Li & Wandschneider, 2005). Feedlots worked on the principle to buy weaned calves and feed them with a ration containing energy, protein, roughage minerals, vitamins, antibiotics and hormones, which resulted in the highest possible weight increase during the shortest possible period of time. The objective is to resell the weaners when they have reached their targeted slaughtering weight. The slaughtering weight of the animal can differ according to the market requirements for the acceptable live weight and fat content (DAER, 2010).

In previous studies done to determine the factors that influence feedlot profitability and risk, actual data from various feedlots were used to perform econometric analysis (Small, Mark & Klopfenstein, 2010; Mark, Schroeder & Jones, 2000; Langemeier, Schroeder & Mintert, 1992). According to Small *et al.* (2010) the factors that influenced the profitability of cattle feedlots the most in Nebraska, USA, were (in order from most to least important) the carcass price, price margin, weaner price and corn price, while the other factors were not significant. Mark *et al.* (2000) found that carcass price and weaner price had the largest impact on feedlot profitability, although corn prices, interest rates and animal performance also played a role. They suggested that feedlots should focus their risk management on the first two factors, but also keep the other in mind. In the study of Langemeier *et al.* (1992) conducted at a feedlot in Kansas, USA, they found that carcass price, weaner price, corn price, interest rates, feed conversion and average daily gain were significant in influencing profitability and together explained 98% of the

variability in profitability. The price of hay and mortality rate did not significantly influence the profitability and was left out of the final results.

Although these studies are useful in the description of the factors that influence profitability, the findings cannot be used to simulate future scenarios regarding feedlot profitability. The study done by Langemeier *et al.* (1992), for instance, suggested that mortality did not have an influence on profitability; this, however, is only true for the feedlot which data they had used for the analysis (the mortality rate was very low). If the same study would have been done on a feedlot with a higher mortality rate, the controversy might have been correct. This question is relevant in the case of an on farm feedlot with a smaller operational scale than that of established feedlots with a lot of managerial experience. It is therefore important to include various parametric budgets with a feedlot enterprise planning or budget to determine the sensitivity of the specific case towards the various variables.

### **3. Methodology and assumptions**

This study is based on a scenario simulating the information (physical and financial) of a smaller, on farm, beef feedlot through a model specifically designed for this purpose by using Microsoft Excel 2007. The model is designed to configure all fixed and variable costs, including the interest on these costs, and the total production value of the enterprise after mortality to finally suggest the margin after interest of the feedlot. The model also calculate the production cost ratio, price margin, feed margin as well as the increased value of the on farm maize that was fed (assuming that the maize was not bought, but produced on the farm). This model is presented in Addendum A. All the variables used in the model are averages and stay the same for analysis purposes, except where otherwise indicated.

The following scenario and assumption were used in this model:

Firstly, it is accepted that it was not necessary to invest in any fixed structures, based on the assumption that the necessary infrastructure for the feedlot was available on the farm. Five-hundred weaners of 230 kg per weaner live weight were bought from outside the farm at R15.50/kg live weight and the transport cost was assumed as R17.00 per weaner. The weaners were fed a mixture of maize and feed concentrate that resulted in a Feed Conversion Ratio (FCR) of 5.8 kg feed per kilogram live weight gain, and an Average Daily Gain (ADG) of 1.5 kg per day. The on-farm price of maize was R1 100 per ton or R1.10 per kg, while the price of the feed concentrate was R3 000 per ton or R3.00 per kg. Maize and concentrate were fed respectively to the ratio of 88:12. The total average veterinary cost was R75.00 per weaner, including antibiotics and growth stimulants or implants. Fixed costs included labour at a minimum wage of R55 per worker per day and a fuel price of R8.18 per litre, while all interest rates were accepted as 10% per annum. The Gross Production Value was based on a mortality rate of 1.5%, transport cost to the abattoir at R17.00 per weaner, an average live marketing weight of 400 kg per weaner, a slaughter percentage of 55%, an A2/3 grading and a carcass price of R26.00 per kg.

## 4. Results from different scenarios

The first scenario is the base scenario, as can be seen in Addendum A, with all the assumptions as described in Section 3. This scenario is based on average variables as obtained from role players in the industry and resulted in a margin after interest of R210 107 for the herd, or R506 per weaner. The difference between the margin for the herd and the margin per weaner multiplied by the number of weaners purchased is caused by the mortality rate of 1.5%. Although the price margin of this scenario is negative, the large positive feed margin caused by the low maize price allows for the positive margin. Assuming that the farmer produced the maize on the farm and had marketed it through the feedlot, the value of the 49.3 ton of maize that was used had increase from R1 100 per ton to R1 584 per ton, or an increase of R484 per ton (given a break-even feedlot margin).

The increase of R484 per ton of maize may look very attractive to a farmer, but it must be kept in mind that these results are obtained from the average values of the variables and that the infrastructure is available. If a farmer wants to start from scratch, the usage of a break-even budget will be necessary. The model allows different scenarios away from the average values and the possible outcome of these scenarios can thus be calculated. Only the variables indicated in each of the following scenarios are changed while the rest are kept constant.

### 4.1 Changes in weaner and carcass prices

Changes in the purchase price of weaners and the carcass price of the slaughtered animals are the factors that influence the profitability of the feedlot the most. Table 2 gives a summary of the different margins that were obtained by different weaner and carcass prices.

**Table 2: Margin after interest with different weaner and carcass prices.**

Weaner Price (R/kg)	A 2/3 Price (R/kg)				
	R 24.00	R 25.00	R 26.00	R 27.00	R 28.00
R 14.50	R 112,068	R 220,418	R 328,768	R 437,118	R 545,468
R 15.00	R 52,738	R 161,088	R 269,438	R 377,788	R 486,138
R 15.50	-R 6,592	R 101,758	R 210,107	R 318,458	R 426,808
R 16.00	-R 65,922	R 42,428	R 150,777	R 259,128	R 367,478
R 16.50	-R 125,252	-R 16,902	R 91,447	R 199,798	R 308,148

The weaner price has a negative correlated influence on profitability, while the carcass price influences it positively. The worst, base and best case scenarios are highlighted in the table. The influence of a R1 change in the weaner purchase price results in a margin change of almost R119 000, while a R1 change in the price of A2/3 carcasses results in a margin change of about R108 000. The worst case scenario (weaner price of R16,50/kg and carcass price of R24/kg) results in a negative margin of R125 252, the base in a positive margin of R201 107 and the best case in a positive margin of R545 468, with a positive price margin of R207 per animal. The value of maize, according to the best case scenario, increases from R1 100 to R2 357 per ton.

## 4.2 Changes in maize and concentrate prices

The change in maize price has a relatively large negative correlated influence on the margin of the feedlot, as can be seen in Table 3, due to the high ratio of maize that is used in this particular feed mix.

**Table 3: Margin after interest with different maize and concentrate prices.**

Maize Price (R/Ton)	Concentrate Price (R/ton)				
	R 3,200	R 3,100	R 3,000	R 2,900	R 2,800
R 900	R 286,235	R 292,245	R 298,255	R 304,265	R 310,275
R 1,100	R 198,085	R 204,095	R 210,107	R 216,115	R 222,125
R 1,300	R 109,935	R 115,945	R 121,957	R 127,965	R 133,975
R 1,500	R 21,785	R 27,795	R 33,807	R 39,815	R 45,825
R 1,700	-R 66,365	-R 60,355	-R 54,343	-R 48,335	-R 42,325
R 1,900	-R 154,515	-R 148,505	-R 142,493	-R 136,485	-R 130,475

The change in price of the feed concentrate also has a negative correlated impact, but other than maize the inclusion in the mix is relatively small and so is the effect on the margin. An increase of R100 per ton in the price of maize will result in a negative correlated change of about R44 000 in the margin, while a R100 change in the price of concentrate will have an influence of R6 000 on the margin. The worst case scenario results in a negative margin of R154 515, the base in a margin of R201 107 and the best case in a margin of R310 275. The break-even price of maize, if the price of concentrate is kept at R3 000 per ton, is about R1 580 per ton. The value of maize, according to the best case scenario, increases from R900 to R1 615 per ton. It is important to note that the margin is negative in the worst case scenario, and will decrease the value of the maize to levels below R1 900 per ton, which is the cost price of maize in this scenario.

## 4.3 Changes in the maize and weaner prices

The relationship between the price of maize and the price of weaners, as provided in Table 4, is one of the important factors in the determination of the maximum price the feedlot is able to pay for weaners to operate at a positive margin.

**Table 4: Margin after interest with different maize and weaner prices.**

Maize Price (R/Ton)	Weaner Price (R/kg)				
	R 16.50	R 16.00	R 15.50	R 15.00	R 14.50
R 900	R 179,595	R 238,926	R 298,257	R 357,588	R 416,919
R 1,100	R 91,445	R 150,776	R 210,107	R 269,438	R 328,769
R 1,300	R 3,295	R 62,626	R 121,957	R 181,288	R 240,619
R 1,500	-R 84,855	-R 25,524	R 33,807	R 93,138	R 152,469
R 1,700	-R 173,005	-R 113,674	-R 54,343	R 4,988	R 64,319
R 1,900	-R 261,155	-R 201,824	-R 142,493	-R 83,162	-R 23,831

The negative correlated impact of both the maize and weaner price on the margin creates a situation where the feedlot is able to pay higher prices for weaners at low maize price and *vice versa*. At a maize price of R1 300 per ton, the feedlot is still able to make a small positive margin at a price of R16,50 per

kilogram for the weaners, but as soon as the price of maize increases to R1 500 per ton, the break-even price of weaners drops to about R16,00 per kilogram. The worst case scenario that can happen between the borders set apart in the table, will result in a negative margin of R261 155, while the best case scenario can realise a positive margin of R416 919.

#### **4.4 Changes in the maize and carcass prices**

The price of maize determines the maximum price a feedlot can pay for weaners and it is also the determinant of the minimum carcass price, as described in Table 5, to still operate at a positive margin.

**Table 5: Margin after interest with different maize and carcass prices.**

Maize Price (R/Ton)	A2/3 Price (R/kg)				
	R 24.00	R 25.00	R 26.00	R 27.00	R 28.00
R 900	R 81,556	R 189,906	R 298,256	R 406,606	R 514,956
R 1,100	-R 6,594	R 101,756	R 210,107	R 318,456	R 426,806
R 1,300	-R 94,744	R 13,606	R 121,957	R 230,306	R 338,656
R 1,500	-R 182,894	-R 74,544	R 33,807	R 142,156	R 250,506
R 1,700	-R 271,044	-R 162,694	-R 54,343	R 54,006	R 162,356
R 1,900	-R 359,194	-R 250,844	-R 142,493	-R 34,144	R 74,206

In this case the maize price is negatively correlated with the margin, while the carcass price is positively correlated with the margin. The higher the price of maize, the higher the price of the carcass should be to realise profits. The base scenario with a maize price of R1 100 per ton will operate at a negative margin if the carcasses are sold at less than about R24.10 per kilogram. An increase in the price of maize to R1 500 per ton will cause the break-even price of carcasses to around R25.70 per kilogram. The worst case scenario for the relationship between maize and carcass prices appears at a maize price of R1 900 per ton and a carcass price of R24.00 per kilogram, realising a negative margin of R359 194, while the best case scenario realises a positive margin of R514 956. The price of carcasses at the time of marketing should be estimated very carefully and have to be compared to the average maize price over the feeding period. An underestimation of only R2 per kilogram for the carcass price can cause a decrease of almost R217 000 in the margin of the feedlot.

#### 4.5 Changes in feed conversion ratio (FCR) and average daily gain (ADG)

FCR and ADG are the measurements of animal performance (productivity) as well as feed quality. The FCR is the amount (kg) of feed needed by the animal to gain 1 kg of live weight and is thus negatively correlated with the margin, while the ADG is positively correlated because it measures the mass (kg) an animal gain per day, and thus decreases the number of days the animal must be fed to reach its target weight.

**Table 6: Margin after interest with different FCR and ADG ratios.**

FCR	Average Daily Gain (Days to Feed)				
	1.3 (131)	1.4 (121)	1.5 (113)	1.6 (106)	1.7 (100)
5.4	R 238,331	R 247,785	R 255,977	R 263,146	R 269,471
5.6	R 215,341	R 224,795	R 232,987	R 240,156	R 246,481
5.8	R 192,351	R 201,805	R 210,107	R 217,166	R 223,491
6.0	R 169,361	R 178,815	R 187,117	R 194,176	R 200,501
6.2	R 146,371	R 155,825	R 164,127	R 171,186	R 177,511

According to Table 5, a change of 0.2 kg feed per kg weight in the FCR results in a negatively correlated margin change of about R23 000, while a change of 0.1 kg in ADG results in a positively correlated



change of R6 000 to R11 000 in the margin, depending on the number of days it shortened the feeding duration. The worst case scenario results in a margin of R146 371, the base in a margin of R201 107 and the best case in a margin of R269 471. The value of maize, according to the best case scenario, increases from R1 100 to R1 767 per ton, and according to the worst case scenario to R1 416 per ton.

#### 4.6 Changes in mortality rate and number of weaners purchased

Although the numbers of weaners in Table 6 that are kept in the feedlot, only affect the total margin in a positively correlated way and have no effect on the margin per weaner or on the change in the value of maize, it is included for reference purposes so that the total margin can be compared with different numbers of weaners in the feedlot.

**Table 7: Margin after interest with different numbers of weaners and mortality rates.**

Mortality Rate (%)	Amount of Calves Purchased				
	200	350	500	650	800
0.5	R 95,449	R 167,036	R 238,623	R 310,210	R 381,797
1.0	R 89,746	R 157,055	R 224,364	R 291,673	R 358,983
1.5	R 84,043	R 147,074	R 210,107	R 273,136	R 336,169
2.0	R 78,340	R 137,093	R 195,848	R 254,599	R 313,355
2.5	R 72,637	R 127,112	R 181,589	R 236,062	R 290,541

The mortality rate, on the other hand, does influence the margin and is negatively correlated with the margin. Using the 500 weaners, for example, a change of 0.5% in the mortality rate will be negatively correlated with a change of just more than R14 000 in the margin. The margin of the best case scenario at a mortality rate of 0.5% will then be R238 623, and the worst case at 2.5% will be R181 589. The difference between the two margins of R57 034 will let the value of the maize decrease from R1 650 for the best case, to R1 519 for the worst case. In feedlots a large number of animals are confined to a relatively small space. The spread of diseases thus happens rapidly and very good precautions must be taken to control diseases and to limit the mortality rate. Therefore, the managerial capability of the farmer will be an important factor in this decision.

#### 4.7 Changes in slaughter percentage and carcass prices

The last set of scenarios that were tested is presented in Table 8 and reveals the effect of different slaughter percentages and carcass prices on the margin of the feedlot.

**Table 8: Margin after interest with different slaughter percentages and carcass prices.**

Slaughter %	A2/3 Price (R/kg)				
	R 24.00	R 25.00	R 26.00	R 27.00	R 28.00
58.0%	R 135,247	R 249,507	R 363,767	R 478,027	R 592,287
56.5%	R 64,327	R 175,632	R 286,937	R 398,242	R 509,547
55.0%	-R 6,593	R 101,757	R 210,107	R 318,457	R 426,807
53.5%	-R 77,513	R 27,882	R 133,277	R 238,672	R 344,067
52.0%	-R 148,433	-R 45,993	R 56,447	R 158,887	R 261,327

Although the large negatively correlated effect of the carcass price variation was already tested on the margin, it was used again to show its effect when combined with the slaughter percentage. The slaughter percentage has a positively correlated effect on the margin, and the margin will decrease with a decrease in slaughter percentage. The value with which a unit changes in the slaughter percentage will change the margin increases as the carcass price increases due to the direct relationship between the two in the calculation of gross production value. At a carcass price of R24.00 per kilogram, a 1.5% change in slaughter percentage will change the margin with about R71 000, while the same unit change in the slaughter percentage at a carcass price of R28.00 per kilogram will change the margin with almost R83 000. Holding the base scenario in mind where the carcass price is R26.00 per kilogram, a decline of 3% in the slaughter percentage will cause the margin to decrease from R201 107 to R56 447, while an increase of 3% in the slaughter percentage will cause the margin to increase to R363 767.

## 5. Conclusion and recommendations

The questions that needed to be answered by the different scenarios that were used in this paper, is whether it is possible to add value to maize by marketing it through cattle, and what factors influence the success of such a feedlot. From the results that were obtained with the different scenarios, it is clear that the value of maize can be increased in most of the cases, compared to selling at spot market prices of R1 100 per ton.

The possibility of a farm operated feedlot to increase the value of the farm's maize crop is determined by the profitability or margin of the feedlot. The higher the margin after interest is, the higher the added value to the maize will be. The primary objective of the feedlot is thus obvious to maximise its margin. In order to reach this goal numerous key factors must be maximised or minimised depending on its correlated influence on the margin. The most important of these factors, which are both quantifiable and measurable, identified in the study are the following:

- weaner price,
- carcass price,
- slaughter percentage,
- feeding cost (maize price),
- feed conversion ratio (FCR),
- mortality rate and
- average daily gain.

The ability of the farmer to manipulate the exact level of several of these influences is very limited, since most of them are driven by supply and demand in the market. Therefore, the production process, while the calves are in the feedlot, must run on maximum efficiency. Although the weaner price, carcass price and slaughter percentage have a bigger influence on the margin, feeding cost represents the largest proportion of the cost allocated to the amount of weight gained. The quality and price of the diet therefore have a considerable impact on the efficiency of converting feed into meat and thus on the margin of the feedlot. The largest part of a feedlot diet is usually made up by maize, and maize thus also contributes to the largest proportion of the price of the total feed mix. The very low maize price that is currently experienced, makes it relatively easy for a feedlot to operate at a positive margin and it is thus possible for a farmer to increase the value of the maize that was produced on the farm and fed to weaners. Regarding the quality of the diet, the slaughter percentage, FCR and ADG are measurements of animal performance or productivity and are partly determined by the quality of the diet. It is thus recommended that different diets and their productivity should be well researched so that the diet with the best returns can be used.

The two factors that influence the margin of the feedlot the most are the price of the weaners that are purchased and the price of the carcasses that must be sold. The first fact that must be kept in mind is that the business of a feedlot is not static but happens over a period of time, usually between 100 and 120 days. The carcass price at the time the weaners must be sold may thus not be the same than at the time they were purchased. An increase in the carcass price over the four months that the animals are fed is very welcome, but what if the price decreases significantly over that time. Good precautions must be taken at the time the weaners are bought to estimate the price at the time of marketing to its most accurate point. The low maize price may lead to a high demand for weaners that will increase the price of weaners for the time being. These weaners will all be fed in feedlots and marketed at about the same time as carcasses, which may cause a high supply in the market putting pressure on the price of carcasses. The high weaner price, and low carcass price four months later, may lead to very low or even negative margins for the feedlots and great care must thus be taken that a feedlot do not end up being caught in this scenario.

The mortality rate of a feedlot, if it moves between acceptable margins, plays a minor role in the determination of the margin of the feedlot if it is compared to the other factors. It must, however, be kept in mind that the mortality rate can increase very rapidly. In a feedlot there is a large number of animals confined to a relatively small space, all receiving the same food and treatment. This do not only quicken the spread of diseases, but if there are something wrong with the feed all the animals will be affected. The feedlot environment must thus be kept as hygienically and healthy as possible through the usage of a good veterinarian programme and effective waste management. Other hygienic factors that may have an influence on the margin because it reduce productivity of the animals are the amount of flies, water quality, feed quality and moisture content of the soil (mud) (Milton as cited by Smith, 2010).

The conclusion of this study is that a feedlot can be profitable and increase the value of the farm produced maize if the right steps are followed and care is taken to ensure the smooth operation of the feedlot. The feedlot sector is very capital intensive to start with. Farmers that consider the feeding of

weaners can thus try to cooperate to reduce the initial capital investment per farmer. The large effect of demand and supply in the South African beef market increases the price risk of a feedlot and the same study must be done on other meat-producing enterprises, such as poultry, to determine if it may be equally or more profitable than the beef sector.

## Addendum A - Feedlot Profitability Base Model

Farm Feedlot Budget: Beef (Page 1)					
		Key:	Variables	Formulas	
<b>Variable Cost</b>					
<b>Variable Cost</b>	<b>Calves Purchased</b>	<b>Amount Calves Purchased</b>	Heads	500	
		<b>Average Purchased Weight</b>	kg / Calf	230	
		<b>Purchased Price per live kg</b>	R / kg	R 15.50	
		<b>Transport Cost per Calf</b>	R / Calf	R 17.00	
		<b>Purchase Price for Calf</b>	R / Calf		R 3 582
		<b>Purchase Price for Herd</b>	R / Herd		R 1 791 000
<b>Variable Cost</b>	<b>Feed Purchased</b>	<b>Days in Feedlot</b>	Days	113	
		<b>Average Daily Gain</b>	kg	1.50	
		<b>Feed Conversion Ratio</b>	kg feed / kg gain	5.8	
		<b>Daily Feed Consumption</b>	kg/Calf/day	8.70	
		<b>Total kg feed / Calf</b>	kg	986	
		<b>Total kg feed / Herd</b>	kg		493000
		<b>Maize</b>	Amount (kg)	867.68	433840
		88%	Price (R/kg)	R 1.10	
		<b>Concentrate</b>	Amount (kg)	118.32	59160
		12%	Price (R/kg)	R 3.00	
		<b>Feed Cost / Calf</b>	R		R 1 309
		<b>Feed Cost / Herd</b>	R		R 654 704
		<b>Variable Cost</b>	<b>Medicine Purchased</b>	<b>Veterinarian Cost</b>	Dose / Calf
	Price (R/Dose)			R 75.00	
<b>Medicine Cost / Calf</b>	R				R 75
<b>Medicine Cost / Herd</b>	R				R 37 500
<b>Total Variable Cost</b>					
<b>Variable Cost</b>	<b>Total Variable Cost</b>	<b>Per Calf</b>	R	R 4 966	
		<b>For Herd</b>	R	R 2 483 204	

**Farm Feedlot Budget: Beef (Page 2)**

		Key:	Variables	Formulas
<b>Fixed Cost</b>				
<b>Fixed Cost</b>	<b>Labour</b>	<b>Workforce</b>	Nr of Workers	2
		<b>Wage</b>	R/worker/day	R 55.00
		<b>Per Calf</b>	R / Calf	R 21
		<b>For Herd</b>	R / Herd	R 10 597
	<b>Fuel and Maintenance</b>	<b>Fuel Price</b>	R / Liter	R 8.18
		<b>Fuel Consumption</b>	Liter / day	18.5
		<b>Fuel Cost</b>	R / day	R 151.33
		<b>Maintenance (100% of Fuel)</b>	R / day	R 151.33
		<b>Per Calf</b>	R / Calf	R 69
		<b>For Herd</b>	R / Herd	R 34 301
	<b>Miscellaneous (5% of other fixed cost)</b>	<b>Amount per Feed Cycle</b>	R / Feed Cycle	R 2 244.91
		<b>Per Calf</b>	R / Calf	R 4
<b>For Herd</b>		R / Herd	R 2 245	
<b>Total Fixed Cost</b>				
<b>Total Fixed Costs</b>	<b>Per Calf</b>	R	<b>R 94</b>	
	<b>For Herd</b>	R	<b>R 47 143</b>	
<b>Interest Paid</b>				
<b>Interest Paid</b>	<b>Calves (100% of time stock is kept)</b>	100%	Interest Rate	10.00%
		<b>Per Calf</b>	R / Calf	R 114
		<b>For Herd</b>	R / Herd	R 57 017
	<b>Feed (% of time stock is kept)</b>	50%	Interest Rate	10.00%
		<b>Per Calf</b>	R / Calf	R 21
		<b>For Herd</b>	R / Herd	R 10 421
	<b>Medicine (% of time stock is kept)</b>	70%	Interest Rate	10.00%
		<b>Per Calf</b>	R / Calf	R 2
		<b>For Herd</b>	R / Herd	R 836
	<b>Fixed Costs (% of time stock is kept)</b>	50%	Interest Rate	10.00%
		<b>Per Calf</b>	R / Calf	R 2
		<b>For Herd</b>	R / Herd	R 750
<b>Total Interest Paid</b>				
<b>Total Interest Paid</b>	<b>Per Calf</b>	R / Calf	<b>R 137</b>	
	<b>For Herd</b>	R / Herd	<b>R 68 274</b>	

**Farm Feedlot Budget: Beef (Page 3)**

		<b>Key:</b>	<b>Variables</b>	<b>Formulas</b>
<b>Production Value</b>				
<b>Production Value</b>	<b>Calves Sold</b>	<b>Mortality Rate</b>	Percentage	1.50%
		<b>Amount of Calves Sold</b>	Heads	493
		<b>Transport Cost per Calf</b>	R/Calf	R 17.00
		<b>Average Live Weight</b>	kg	400
		<b>Slaughter Percentage</b>	Percentage	55.00%
		<b>Carcass Weight</b>	kg	220
		<b>A 2/3 Carcass Price</b>	R/kg	R 26.00
<b>Gross Production Value</b>				
<b>Gross Production Value</b>	<b>Per Carcass</b>	R / kg	<b>R 5 703</b>	
	<b>For Herd</b>	R / kg	<b>R 2 808 728</b>	
<b>Feedlot Margin</b>				
<b>Gross Production Value</b>	<b>Per Carcass</b>	R / Calf	<b>R 5 703</b>	
	<b>For Herd</b>	R / Herd	<b>R 2 808 728</b>	
<b>(Total Variable Cost)</b>	<b>Per Calf</b>	R / Calf	<b>-R 4 966</b>	
	<b>For Herd</b>	R / Herd	<b>-R 2 483 204</b>	
<b>Gross Margin</b>	<b>Per Calf</b>	R / Calf	<b>R 737</b>	
	<b>For Herd</b>	R / Herd	<b>R 325 524</b>	
<b>(Total Fixed Cost)</b>	<b>Per Calf</b>	R / Calf	<b>-R 94</b>	
	<b>For Herd</b>	R / Herd	<b>-R 47 143</b>	
<b>Nett Margin</b>	<b>Per Calf</b>	R / Calf	<b>R 642</b>	
	<b>For Herd</b>	R / Herd	<b>R 278 380</b>	
<b>(Total Interest Paid)</b>	<b>Per Calf</b>	R / Calf	<b>-R 137</b>	
	<b>For Herd</b>	R / Herd	<b>-R 68 274</b>	
<b>Margin After Interest</b>				
<b>Margin after Interest</b>	<b>Per Carcass</b>	R / Calf	<b>R 506</b>	
	<b>For Herd</b>	R / Herd	<b>R 210 107</b>	

**Farm Feedlot Budget: Beef (Page 4)**

		<b>Key:</b>	<b>Variables</b>	<b>Formulas</b>
<b>Ratios</b>				
<b>Production Cost Ratio</b>	(Total Cost / Gross Production Value)*100	%		93%
<b>Price Margin</b>	Purchased Weight * (Sale price/kg - Cost price/kg)	R / Calf		-R 276
<b>Feed Margin</b>	Weight Gain * (Sale price/kg - cost/kg gained)	R / Calf		R 1 122
<b>Increased Value of Maize</b>				
<b>Value of Maize</b>	<b>Per ton</b>	R/ton		<b>R 1 584</b>
<b>Price of Maize</b>	<b>Per ton</b>	R/ton		<b>R 1 100</b>
<b>Increase in Value</b>	<b>Per ton</b>	R/ton		<b>R 484</b>



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