# SHOULD MAIZE FARMERS CONSIDER A LONG TERM FEEDLOT IN RESPONSE TO LOW MAIZE PRICES: THE CASE OF THE SOUTH AFRICAN MARKET

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**Abstract**

*The decrease in South African maize prices has led to a situation where producers are facing problems to cover their input costs. The meat sector came up as an alternative and maize producers begin to explore the possibility of marketing their maize through cattle to increase the value of their crop. A feedlot simulating model is used to run different price scenarios and the conclusion is that a feedlot can be profitable and that the value of the maize can be increased at average market prices. It was further found that small changes in input prices (weaner price, carcass price, maize price etc.) have a large influence on the profitability of a feedlot. Future scenarios, using estimated input prices, indicate that the outlook for an on farm beef feedlot is positive and that it may justify the initial investment cost of the feedlot. Maize producers can therefore consider a long term feedlot as a marketing alternative for their maize, but careful planning, good price estimates and superb management are essential for the success of such an enterprise. The vertical expansion of the farm through a feedlot not only adds value to the produced maize, but it also eliminates maize transport costs and spread the risks of the farm.*

*Keywords:* Maize price, beef feedlot, profitability, scenarios

*Sub theme*: Farm Management

## 1. Introduction

The sudden and steep decrease in the South African maize price since the beginning of 2010, as a result of a near record crop, has lead to a situation where producers face problems to cover their input costs. The increase in production is caused by improvements in technology, both cultivation methods and seed cultivars, together with a good rain season. Local consumption did not increase to the same extentl and this, together with the low export capacity of South Africa, results in an oversupply of maize. Maize producers are forced to search for alternative ways to market their crops in order to try and increase the value of their product by a margin that will at least cover their input costs. Various different alternative marketing options were discussed between farmers and workgroups within the maize sector, but the possible success rate of these options is limited.

Grain SA, for example, wanted to administer an export pool to isolate approximately 5 million tons of maize for the export market (Laubscher, 2010). Although this transaction probably would have taken place at export parity prices, and may not improve the short-term low price problem, the result would have been lower ending stocks in South Africa and thus, hopefully, an increase in price for the next production season. After applying to the Competition Commission for exemption, allowing them to set up the export pool, the commission responded that such an action would be illegal due to its anti-competitive nature. Being turned down from international marketing opportunities, the producers have had to start exploring the domestic markets. One of these markets that can be developed to consume



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the oversupply of not only maize, but also oilseeds, is the bio-fuel market. The expansion of the bio-fuel market may significantly contribute to the fuel needs of the country while it also delivers valuable by-products such as dry distillers grain with solubles (DDGS), which can be used as a protein feed for livestock, as well as $CO_2$ gas (Van Rooyen, 2010). The South African Government however, decided that maize may not be used for ethanol production since it is a staple food. Thus, this very appealing market for the oversupply of maize will also not open up.

With the above two marketing options thrown out and the near record crop coming in, pushing the estimated carry-over stock of maize in South Africa to levels double that of the previous year, producers are still searching for alternatives to try and obtain prices for their commodity that can allow them to cover at least their input costs and cut the losses to a minimum. The growing meat sector with continuous increasing prices came under the attention of maize producers as maize is a feedstuff for cattle. Maize can thus be marketed through cattle in order to increase the price of the crop. The decline in maize prices, and the increase in beef prices, has increased the ratio of the beef price relative to the maize price (beef/maize price ratio) to the highest levels in the last four years (Willemse, 2010). It is an indication that beef can be produced very profitably due to low feed costs (maize) and the profits realised by the beef production may increase the price of the maize that is fed to cattle.

## 2. Problem statement

The feedlot sector is characterised by relative low fixed costs, but very high input costs. This leads to a situation where there is a very small difference between the break-even point of the feedlot and the shut-down point. A small change in price of inputs such as feedstuff (maize, roughage, feed concentrate), calves and other inputs or in the price of the product (A2/3 grade beef) may thus contribute to either high economic profits or the closing of the feedlot. Other factors such as the performance of the animals (feed conversion ratio, average daily gain) and the mortality rate are also very important in profit or loss determination and should be kept in mind. Maize producers that consider the feeding of cattle are thus left with a lot of variables that can influence their fate. Work by previous authors is based on actual feedlot data (Small, Mark & Klopfenstein, 2010; Mark, Schroeder & Jones, 2000; Langemeier, Schroeder & Mintert, 1992). These authors managed to identify the factors that influence profitability, but their findings cannot be used to simulate future scenarios. Langemeier *et al.* (1992), for instance, found that the mortality rate of a feedlot does not have a significant influence on the profitability. This may be true for the specific feedlot of which the data was used, but one cannot generalise this statement for all feedlots. The question thus arises of how does a maize producer, who cannot afford any more losses, determine beforehand if a feedlot enterprise on the farm will be successful?

A beef feedlot is a capital and management intensive enterprise. The second problem that faces the maize producer, who wants to start a feedlot, is whether capital must be invested in the required infrastructure of a feedlot. The infrastructure of a feedlot is immovable and to justify the cost of it, the feedlot must show positive returns on investment for more than one year and basically become a full-time enterprise on the maize farm.

The objective of this paper is to answer these questions. Firstly, there will be determined whether a feedlot can be used to increase the farm value of maize, and what the factors are that can mostly influence the profitability of the on-farm feedlot. The second objective is to determine the future viability and outlook of a beef feedlot on the farm and if the enterprise can justify its initial high capital investment.


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## 3. Methodology and assumptions

The model used for the analyses of this study is a scenario simulator specifically designed in Microsoft Excel 2007 to simulate the possible financial and physical outcome of a small scale feedlot. The model configures all fixed and variable costs and together with the production value it calculates the estimated margin after interest for the feedlot. Further, it also calculates the estimated production cost ratio, price margin, feed margin and the increase in the value of the maize that is fed during the cycle. A base scenario is created with average values and prices as they are at the time of the study. The other analysis is done with all the values of the base scenario staying the same, except for the value under investigation. The values and prices for the base scenario are set out in Table 1 with an approximate R / US$ exchange rate on the time being of R 7.30.

For the base scenario it is assumed that the necessary infrastructure for the feedlot is available on the farm, since the majority of cash-crop farms already have some kind of livestock enterprise.

**Table 1: Prices and values of the base feedlot scenario**

| Variable | Price / Value |
|---|---|
| Weaners Purchased | |
| Amount | 500 head |
| Live Weight | 230 kg |
| Price | R15.50 / kg |
| Feed | |
| Maize (88%) | R1 100 / ton |
| Concentrate (12%) | R3 000 / ton |
| Feed Conversion Ratio (FCR) | 5.8 kg feed / kg live weight |
| Average Daily Gain (ADG) | 1.5 kg live weight / day |
| Veterinary Cost | R75 / weaner |
| Labour | R55 / worker / day |
| Fuel | R8.18 / litre |
| Interest Rate | 10% / annum |
| Mortality Rate | 1.5 % |
| Transport of animals | R17 / animal / trip |
| Animals Slaughtered | |
| Amount | 493 heads |
| Live Weight | 400 kg |
| Slaughter Percentage | 55% |
| A2/3 Carcass Price | R26 / kg |

## 4. Results from different scenarios

The base scenario was run through the model with the values and prices as described in Table 1. The results for this scenario are shown in Table 2 and suggests that it is possible for a maize producer to obtain a positive margin after interest based on these assumptions.



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**Table 2: Results from base scenario**

| Margin / Ratio | Value |
|---|---|
| Margin after interest | R210 107 |
| Production cost ratio | 93% |
| Price margin | -R267 / calf |
| Feed margin | R1 122 / calf |
| Value of maize | |
| Original price | R1 100 / ton |
| New value | R1 584 / ton |
| Added value | R484 / ton |

The positive margin after interest is caused by the large feed margin that has neutralised the negative price margin. This indicates that weaners can be fed economically due to low maize prices. The feedlot margin divided by the amount of maize use (433.8 ton) give an added value of R484 / ton of maize.
The outcome of the base scenario does look positive and may create an opportunity for maize producers who are struggling to cover their input cost. It must be remembered that these results are obtained from average values. The profitability of the feedlot sector is influenced by a relatively large number of variables, each with a positive or negative influence on the margin after interest. To run scenarios with values deviating from the averages Toprank® 5.5 is used. The program assigns a range of different values to each variable in the model and indicates how each variable can influence profitability. Only one variable changes at a time, *ceteris paribus*, and the ranges in which each variable are allow to vary are presented in Table 3. The outcomes of the different scenarios are presented in a tornado graph (Figure 1) so that the changes in the margin after interest can be compared.

**Table 3: Allowed ranges for variable changes**

| Variable | Result in lowest margin | Base margin R210 107 | Result in highest margin |
|---|---|---|---|
| Maize price | R1 900 / ton | R1 100 / ton | R900 / ton |
| Carcass price | R24 / kg | R26 / kg | R28 / kg |
| Slaughter percentage | 52% | 55% | 58% |
| Weaner price | R16.50 / kg | R15.50 / kg | R14.50 / kg |
| FCR | 6.2 kg | 5.8 kg | 5.4 kg |
| Mortality rate | 2.5 % | 1.5 % | 0.5 % |
| ADG | 1.3 kg / day | 1.5 kg / day | 1.7 kg / day |
| Concentrate price | R3 200 / ton | R3 000 / ton | R2 800 / ton |


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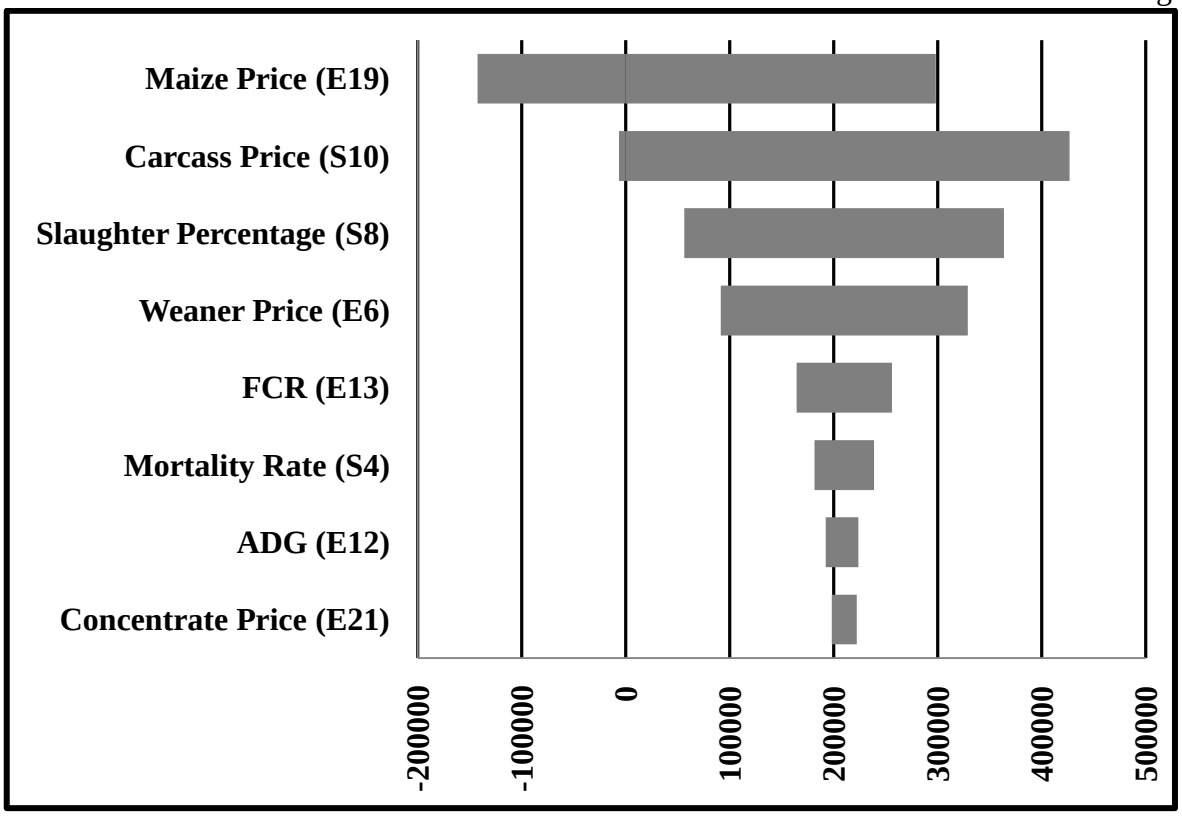


**Figure 1: Tornado graph of margin after interest - Impact by variable**

The variables in Table 3 and Figure 1 are only the top eight variables that largely influence the margin after interest, given the ranges they are allowed to move in. The influence of the maize price on the margin skews the graph, due to the fact that the maize price is not allowed to move even distances away from the base in both directions. The tornado graph indicates that the maize price has the largest influence on the margin after interest and the concentrate price the smallest. This, however, is not necessarily true. It must be kept in mind that these results are obtained from variables that are allowed to move only within certain ranges.

To determine which variable will influence the margin the most, all the variables must be varied by the same unit. To achieve this, the metric units are changed to percentages and the elasticity coefficients (ε) are determined by calculating the change in the margin after interest due to a one percent (1%) change in each variable (table 4).



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**Table 4: Elasticity coefficients of variables**

| Input | 1% Change (Unit) | Elasticity (ε) | Margin Change (R) |
|---|---|---|---|
| Slaughter Percentage | 1% | 23.71 | 51 272 |
| Mortality Rate | 1% | -13.57 | 28 515 |
| Carcass Price | R 0.26 | 13.41 | 28 142 |
| Weaner Price | R 0.15 | -8.75 | 18 369 |
| FCR | 0.057kg | -3.17 | 6 648 |
| Maize Price | R11/t | -2.31 | 4 844 |
| Concentrate Price | R30/t | -0.86 | 1 805 |
| ADG | 0.015kg | 0.63 | 1 332 |

The elasticity coefficients indicates that slaughter percentage has the largest influence on the margin after interest and average daily gain the smallest influence. Slaughter percentage, however, is almost a given factor and it is very difficult for the farmer to change it. Mortality rate, with the second largest influence, can be controlled with good hygiene and veterinary practices. The factors that the farmer should carefully monitor are those which is less or uncontrollable and is determined by the market. The carcass price, weaner price and maize price is the most important factors, not only because the farmer cannot control them but also because the changes in these prices are usually larger than those indicated in table 4. A change of R1.00/kg in the carcass and weaner price will change the margin with R108 350 and R118 661 respectively, while a change of R100.00/ton in the maize price will change the margin with R44 075. Although it may be argued that the increase in demand for weaners will increase the price of weaners, given that the supply cannot suddenly be increased, this will not necessarily happen. The price of weaners is limited by the carcass price for beef as the ratio between the two is a large determinant of feedlot profit.

The results from the scenarios show that it is possible to realise a positive margin after interest with a farm based beef feedlot and increase the value of the maize fed. It is also possible on the other hand, to realise a negative margin. There are a few factors that strongly correlate with the margin and these variables should therefore be controlled and estimated very carefully. The question that still remains unanswered is whether the scenario for beef feedlot profitability over the next few years may justify an investment in fixed feedlot infrastructure?

## 5. Future scenario for beef feedlot profitability

Maize farmers, who do not have the available infrastructure for a beef feedlot on their farm, have to invest in such structures. The investment in feedlot infrastructure can only be justified if the feedlot results in a positive margin after interest for more than one year. The large variations that may occur in the initial capital investment between the different farm feedlots, due to variation in amount of animals kept and other factors, make it impossible to include a specific value in scenario simulations. A breakeven budget for each individual farm must be done to calculate the maximum capital investment in infrastructure for the specific feedlot setup.

To determine the future profitability, scenarios are created with the average estimated prices for the variable inputs as obtained from BFAP (2010) and based on own calculations. The original base scenario is used for the year 2010, while the estimate prices are used for the years 2011 - 2014. Data from previous years (2006 - 2009) are included using the actual average prices as it was recorded in those


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years. These historical data were included to compare the future of feedlot profitability with the past. The comparison is create by using the "What if?" analysis from Microsoft Excel 2007 and is present in table 5.


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**Table 5: "What if?" analysis for feedlot profitability over time**

| Scenario Summary | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** |
| **Changing Cells:** | | | | | | | | | |
| Carcass Price | R 21.23 | R 22.90 | R 23.50 | R 25.29 | R 26.00 | R 26.80 | R 28.00 | R 29.00 | R 30.50 |
| Maize | R 1.42 | R 1.85 | R 1.77 | R 1.53 | R 1.10 | R 1.30 | R 1.50 | R 1.60 | R 1.70 |
| Concentrate | R 2.29 | R 2.45 | R 2.62 | R 2.80 | R 3.00 | R 3.21 | R 3.43 | R 3.68 | R 3.93 |
| Weaner Price | R 13.19 | R 13.20 | R 13.21 | R 13.33 | R 15.50 | R 14.50 | R 15.50 | R 16.00 | R 17.00 |
| Transport | R 12.97 | R 13.88 | R 14.85 | R 15.89 | R 17.00 | R 18.19 | R 19.46 | R 20.83 | R 22.28 |
| Veterinary Cost | R 57.22 | R 61.22 | R 65.51 | R 70.09 | R 75.00 | R 80.25 | R 85.87 | R 91.88 | R 98.31 |
| Wages | R 40.80 | R 42.72 | R 44.72 | R 50.48 | R 55.00 | R 57.60 | R 61.60 | R 65.84 | R 70.40 |
| Fuel | R 6.24 | R 6.68 | R 7.14 | R 7.64 | R 8.18 | R 8.75 | R 9.37 | R 10.02 | R 10.72 |
| Interest Rate | 11.60% | 13.20% | 15.10% | 13.00% | 10.00% | 11.00% | 11.50% | 12.00% | 12.00% |
| **Result Cells:** | | | | | | | | | |
| Margin after interest | -R 116,191 | -R 151,662 | -R 80,468 | R 201,182 | R 210,107 | R 301,131 | R 199,313 | R 176,910 | R 151,984 |
| Production Cost Ration | 105% | 106% | 103% | 93% | 93% | 90% | 93% | 94% | 95% |
| Price Margin | -R 348 | -R 139 | -R 66 | R 133 | -R 276 | R 55 | -R 23 | -R 11 | -R 52 |
| Feed Margin | R 482 | R 246 | R 351 | R 706 | R 1,122 | R 998 | R 911 | R 888 | R 912 |
| New Value of Maize | R 1,152 | R 1,500 | R 1,585 | R 1,994 | R 1,584 | R 1,994 | R 1,959 | R 2,008 | R 2,050 |
| Price of Maize | R 1,420 | R 1,850 | R 1,770 | R 1,530 | R 1,100 | R 1,300 | R 1,500 | R 1,600 | R 1,700 |
| Change in Maize Value | -R 268 | -R 350 | -R 185 | R 464 | R 484 | R 694 | R 459 | R 408 | R 350 |



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The margin after interest, for the years 2006 – 2008, was negative due to two contributing factors. The first factor is the high maize prices during those years that resulted in a very low feed margin. The second contributing factor was the relatively small difference between the weaner and carcass prices and this resulted in a negative price margin for the feedlot. The large negative effect of the price margin was greater than positive effect of the feed margin and the margin after interest was thus negative.

In 2009 a substantial increase in the carcass price, with a relative stable weaner price from the previous year, resulted in a positive price margin. The increase in the price of maize was neutralised by the high carcass prices and this contributed to a larger positive feed margin. The margin after interest was positive, causing the value of the fed maize to increase. The current scenario during 2010 is recognised by a large positive feed margin, due to the very low maize price, but also a large negative price margin due to the unfavourable ratio between weaner and carcass prices. The margin after interest, however, is the best for the previous few years and maize producers can add some extra value to the fed maize.

The feedlot outlook for the years 2011 - 2014 is very positive. The price margin for all the years do not vary far from zero and remain almost insignificant, while the feed margin remains positive on very high levels. Although it is expected that the maize price may increase steadily over the next few years, the effect of the increasing carcass price relative to the weaner price is larger and the outlook for the margin after interest remains positive. Maize producers may therefore consider an investment in an on-farm feedlot, as the future for beef feedlots is positive given the expected price trends. The model can also be used to revaluate the maize farmer's options for the marketing of his maize before the harvesting of the crop even starts.

## 6. Conclusion

The first question answered by this paper is whether an on-farm beef feedlot on a cash crop farm can be used successfully to increase the value of the farm produce maize. By using the feedlot simulating model to run different price scenarios it is determined that the value of the maize can be increased at average prices as stated in the base scenario. Producers must however, carefully consider all the different aspects or factors that influence the profitability of the feedlot. Small changes in the factors such as the weaner price, carcass price and maize price will have a large influence on the profitability of the feedlot. The model that is used assumes that the necessary infrastructure for the feedlot is available on the farm, since many cash crop farms have livestock enterprises too.

The second question that is answered is directed towards maize producers who do not have the necessary infrastructure for a feedlot on the farm. It will make no sense for these farmers to invest in a feedlot if the returns from the feedlot cannot justify the initial capital investment of the feedlot over time. The future scenarios based on estimated prices for the next four years provide a positive outlook. It is determined that the profitability of the feedlot can be even higher in 2011 than in 2010. After 2011 the profitability may slowly decrease over the next three years, but it may remain positive. This information provides evidence that the future of a beef feedlot seems positive, but it cannot be used to justify the initial capital investment of the feedlot unless a break even budget is compiled.

Maize producers will not be able to produce maize profitably if the price does not increase, unless they can lower their production cost or increase the value of their crop. Some of the smaller producers may thus leave the industry, but larger role players will try different options in order to maintain keep producing. To lower production cost farmers must expand their operations horizontally and acquire more land to increase their economics of scale. In order to do this they will have to make large capital investments and the price of additional land may not be justified by the decrease in production cost.



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The other option, of which this paper can be use for evidence, is value adding the product. By expanding the operations vertically with a feedlot value can be added to the produced maize. This vertical expansion will not only add value to the product, but it also eliminates the transport cost of the product and spread the risks of the farming enterprise.

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